The
GEOGRAPHICAL JOURNAL

Vol LXXXII No 5 R.G.S. *November 1933*

THE OXFORD UNIVERSITY EXPEDITION TO SARAWAK, 1932: *A paper read at the Evening Meeting of the Society on 12 June 1933, by*

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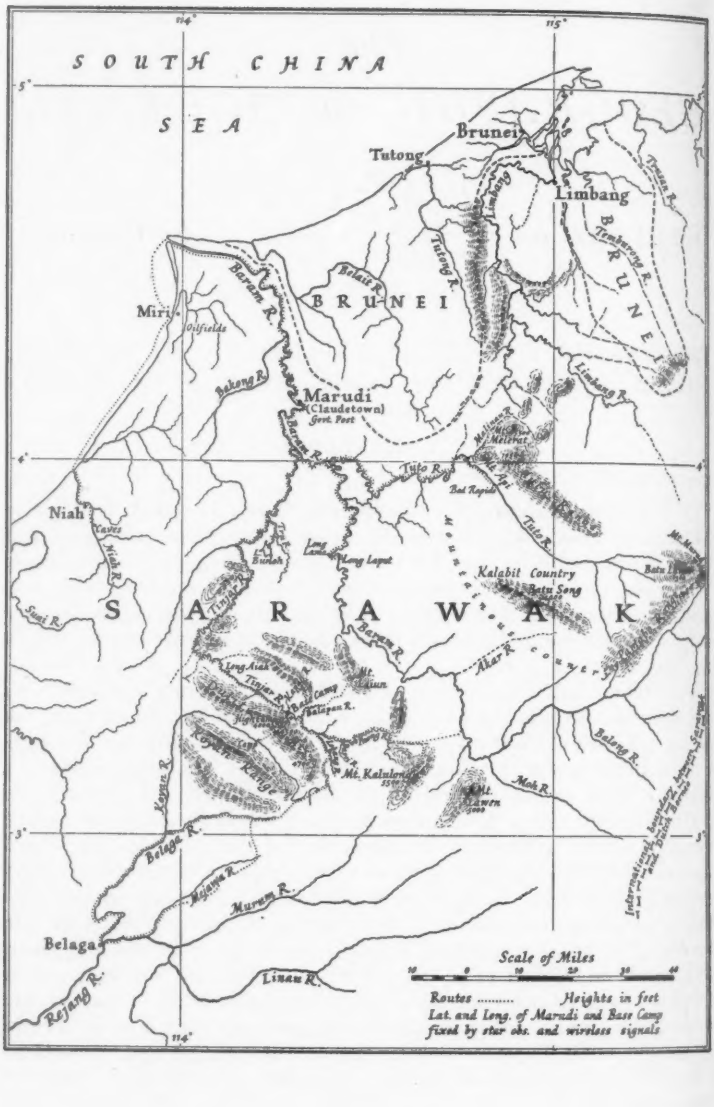
General and Historical

THE Oxford University Sarawak (Borneo) Expedition, 1932, went out in order to make a detailed scientific survey—geographical, zoological, and botanical—in the Dulit area of Central Sarawak. Borneo mountains above 3000 feet have a unique flora and fauna, and this made Mount Dulit (4800 feet) particularly attractive. The duration of the expedition, June 1932 to January 1933, was controlled by University terms, and meant we had to work partly in the rainy season.

The Dulit range, which is composed of Miocene limestone with a W.S.W. dip, runs for about 30 miles along the south bank of the Tinjar river, the largest tributary of the Baram. The first white man to make any investigations in this area was the famous naturalist, Charles Hose, then resident at Marudi (Baram or Claudetown) on the Baram. Whitehead's pioneer work (1885–1887) on Mount Kinibalu in British North Borneo and the highest mountain in the archipelago (13,680 feet), and the many new birds and mammals described from his collections, stimulated Hose to travel for five days up the Tinjar to Long Kapah (only a mile from our 1932 base camp); from there he made the first ascent of Dulit, starting on 20 September 1891. He reached 4000 feet on September 23, and spent three weeks collecting about that height; on October 13 he attained the summit for the first time, and on October 16 spent a miserable night there in characteristic Dulit weather. He made the height to be 5090 feet, which is too great. His route is not clear from his account, but it almost certainly lay farther west than that used by us. Hose returned to Long Kapah on October 27, having obtained many birds and mammals which proved to be new to science—and many of them known only from his single specimens until our visit.

On 6 February 1899 Dr. Alfred C. Haddon and Prof. W. McDougall, two eminent members of the Cambridge Torres Straits Expedition, went up the Tinjar with Hose. They reached Long Aiah (some 15 miles below our base camp), where Hose left them on February 13, and from there travelled a short



Area of the Oxford University Exploration Club's Expedition to Sarawak

distance up the Scott Keltie River (named in honour of the then Secretary of this Society). They soon left the river, and on February 16 were within easy distance of the summit. Haddon was not well, so McDougall made the ascent alone, naming the peak climbed Cambridge Peak. They returned to Long Aiah on February 17. From Haddon's account their route was a good many miles west of ours, and the Scott Keltie River and Falls, which we were unable to identify, must lie in that direction. In 1919 the Raffles Museum, Singapore, sent two Dyak collectors to Dulit, but they do not appear to have gone above 4000 feet. Finally, in 1923, Dr. Eric Mjöberg, late curator of the Sarawak Museum, visited the area and sent his collectors up to about 3000 feet.

Other mountains in Sarawak have been climbed, chiefly by zoologists collecting in the mountain fauna zones. Penrissen (4450 feet) and Poi (6460 feet), both near Kuching, in south Sarawak, are fairly accessible and have been visited on several occasions; important collections have been made by A. H. Everett in 1892, and Dr. E. Mjöberg in 1923 and 1924. North of Dulit, in the extreme north of Sarawak, are Murud (7200 feet), climbed by Mjöberg in 1923; and Batu Lawi (6300 feet), visited by J. C. Moulton in 1911, though the main peak has not and probably never will be climbed. Batu Song (4000 feet), 50 miles from Dulit, has been visited by Hose's collectors; the Pamabo range and the remarkable Kalabit country (av. 3000 feet) have been visited at intervals by Government officers. Mulu (7950 feet) and Kalulong (5500 feet) were climbed for the first time by us in 1932, though the lower levels on each have been visited by native collectors (1893, etc.). Still unclimbed are Temeduk or Gunong Lawen (*c.* 5000 feet), near Kalulong; a number of peaks over 5000 feet in the Mulu area; Tiban (6200 feet) and Tibong—the mountain mass which gives rise to the Rejang river; and a great chain of mountains all along the Dutch border to the Schwaner (up to 7470 feet) and Müller ranges. These peaks are of the utmost interest, and it is to be hoped that before long they will be visited by scientists, and especially by biologists. There is still a great deal of exploration to be done in Sarawak, not only on the mountains but in the headwaters of the great river systems.

Organization

The Oxford University Sarawak Expedition, 1932, was an enterprise of the Oxford University Exploration Club. The organization, raising of funds, and selection of personnel were undertaken by me with the help of Charles Elton, Chairman of the Club. Mr. E. Banks, Curator of the Sarawak Museum, was leader of the expedition and made all arrangements in the country. Our plans were made possible by the moral and financial support of Oxford University who gave £50, and of the Royal Geographical Society who gave us £100, and by grant and assistance from the Percy Sladen Memorial Trust who gave £500; the British Museum (Natural History) (£100), the Royal Society (£125), Magdalen College (Oxford), and Imperial Chemicals Industries Ltd. Mr. John Buchan, M.P., Sir Jeremiah Colman, Bart., Lord Howard de Walden, Major the Hon. J. J. Astor, M.P., Lord Riddell, an anonymous supporter, and members of the expedition produced the remaining £1705. The total sum raised was £2580, which just covered expenses. Every facility was given us by H.H. the Rajah of Sarawak, Sir Charles Vyner Brooke, and by Mr. F. F. Boult

as his representative in London. I personally am especially beholden to Dr. T. G. Longstaff for his help and advice at every stage in the expedition's plans. The expedition personnel was composed of six Oxford and three Cambridge graduates and under-graduates, as follows: E. Banks (leader), J. Ford (general zoologist), T. H. Harrisson (ornithologist and mammalogist), C. H. Hartley (assistant ornithologist), B. M. Hobby (entomologist), A. W. Moore (second entomologist), P. W. Richards (botanist), E. A. Shackleton (surveyor), P. M. Synge (photographer and assistant botanist). The Forestry Department lent us Mr. G. MacLeod in August, and he was invaluable in getting things under way. Mr. C. N. Hammond helped in the survey work at the end of August. Malay surveyors, forest officers, and museum collectors were lent to us by the Government for the whole duration of our stay. The Botanic Gardens, Singapore, lent apparatus and the services of a Malay collector.

The expedition was equipped with every reasonable comfort, good camps, and comparatively luxurious food, thanks to the extreme care and skilled experience of the leader, and also of the District Officer, Mr. F. H. Pollard, who was involved in much arduous work in preparing camp sites and organizing native labour. Our plan was to spend the first three months in an intensive scientific survey in the Dulit area, irrespective of all other considerations; to do this really well we needed optimism, good health, and morale. Then, the first job being done, for the last month every one was free to go wherever he pleased, preferably into unknown country, provided everything possible was done to ensure a reasonable margin of safety. This plan worked well.

Approach

We left Liverpool on 18 June 1932 on the s.s. *Patroclus*, of the Blue Funnel Line, who, here as elsewhere, extended to us every courtesy and concession. We reached Singapore on July 16, left the same day for Kuching, where Mr. Banks met us and we went through Government formalities, being entertained by Mr. J. C. Swayne, the Chief Secretary, and travelling on by H.H. the Rajah's steam yacht *Maimuna*, which he kindly lent to us. At Miri we were most hospitably treated by Mr. A. H. Noble and Sarawak Oilfields, Ltd., and by Government officers stationed there. Throughout our stay the officers of Sarawak Oilfields greatly facilitated our supply system and helped us in every possible way. We left again on the *Maimuna* when all our gear was ready and steamed up the Baram to Marudi, the Government outstation, lat. 4° 10′ 40″ N., long. 114° 19′ 15″ E. Here we were looked after by the administrative cadet, Mr. D. C. White, who allowed us to use his house as an hotel and helped us in innumerable ways throughout our stay in the country. An advance party (Banks, Hartley, Moore, Richards and myself) left Marudi on July 27. On our way up river we spent our first night in a Long House, which may hold anything from a hundred to a thousand people. The European is always given the headman's room and food, and he is treated as a respected friend, a "superior equal," by the native; he enjoys a position which must be unique, for there is no trouble about prestige or colour bar; the white man is expected to join in every sort of native activity, to drink with them, to join in all ceremonies, and so on. The more native bangles and tattoo marks he has the better. If he can charleston or do conjuring tricks he is bound to be a success.

Base Camp on the bank of the Tinjar

Photographs, unless otherwise attributed, by P. M. Synge

High Camp at 4000 feet, Dulit Ridge

Poling up rapids in the upper reaches of the Tinjar

Dulit Ridge moss forest: pool at foot of waterfall

The country is quite undeveloped; no roads except in two or three coastal towns, no education or interference of any sort with the aborigines. Ever since Sir James Brooke, the first white Rajah, took over Sarawak in 1841 the country has been faithfully run for the natives and for the natives only. It will be a tragedy if this tradition is ever broken, or Sarawak is ever "developed," as it so easily could be. The insidious feelers of civilization are slowly creeping in, mainly through Chinese influence, but they have yet a long way to go before they do serious damage.

The Base Camp

On 29 July 1932 we reached the base camp (lat. 3° 18′ 53″ N., long. 114° 17′ 23″ E.) at the foot of the Dulit range beside the mouth of a small stream, the Lejok (also spelled Leju), half a mile above a larger stream, the Kapah; the site was a good one, 40 feet above the main Tinjar river. The Europeans' house had four rooms, each roughly 24 by 24 feet, opening into the centre. The Malay house was about half this size, and the coolie house was a long house in miniature. Each was set on 8–12-foot piles. The river can rise 40 feet in the night; on one occasion the coolie house was entirely flooded and water came within 3 inches of the floor in our house, while the whole place was literally crawling with beetles, spiders, centipedes, scorpions, and snakes seeking refuge from the waters (September 6).

Our arrival caused great interest among the natives, and hundreds of aborigines came in to see us. The people with whom we were most concerned were those living on the Tinjar, which is about 170 miles long from source to junction with the Baram, 18 miles above Marudi and 80 miles from the sea, giving a total length of about 250 miles; our camp was just under 200 miles from the sea. The total Tinjar population is somewhere over two thousand (rough estimate) living in about fifteen long houses on the river; in the Dulit area there are five houses in 40 miles and five others in the headwaters of the Dapoi, Lobang, and Nibong. Men from all the five tribes represented in the area worked for us. On the whole the Kenyahs proved the best workers and collectors, especially those from the house of Long Atun. They are essentially agriculturists, efficient and contented farmers, very hospitable and generous, though physically not so strong as some other tribes. Punans were the second most numerous of our coolies; they carry greater weights than any others, and a Punan woman will do the work of a Kenyah man. They are nomads living in small communities in flimsy shelters, never settling long in one place, having no rice or tobacco, feeding on wild fruits and on animals snared or shot with blowpipes. In the last few years the Government have tried to make these people settle down and build long houses; they have in some cases succeeded, and even in one generation these domesticated Punans have degenerated so that they cannot compare with those still free. All Punans have an unhappy knack of going dead stupid when it suits them, which makes them useless collectors, while they are the only local people who will go back on their word. Many do not understand Malay—the other tribes speak a pidgin Malay, as well as their own language. Therefore they should not form the nucleus of a party working new or difficult country; though they are valuable as carriers in any ordinary transport scheme. A good many Lirongs and Sĕbops, as well

as a few Barawans, worked for us; all were reliable, especially the less intelligent ones.

The non-nomadic tribes have a primitive agricultural system which consists of felling a forest area, burning as much as possible of the felled trees and planting padi (rice) in the clearing. New clearings are constantly made and old ones abandoned, so that huge areas in some parts of the country, and the riverside belt always in populated districts, have little or no virgin forest, but are covered with a thick, secondary jungle grown up from the clearings. This is an important point for the zoologist or botanist, who must choose a suitable area with virgin forest easily available, and will find it far from easy to do so. The padi-planting also makes it difficult to hire labour from September to early November, when the men have to take their share in the work, while in July and August they are busy felling and burning. Government backing is valuable in influencing native opinion when men are needed during this period, but where possible it is better not to travel after July, both for these and for climatic reasons. We required a permanent staff of fifty or sixty natives; we solved the problem by employing men for short periods, and before we left most of the young men in the district had worked for us at one time or another. A nucleus remained all through, including two young chiefs who acted as headmen, Morah (now chief of the whole district) and Uyau Usa, a Kenyah from Long Atun. A large proportion of the inhabitants have committed adultery or been divorced. This was very convenient from our point of view, for it meant that several men worked for us all the time to pay fines and alimony to the parties concerned; they provided some of our best collectors because they stayed long enough to learn more about the animals and plants than any one else. No one need be afraid that he will be unable to hire any labour at all, so long as the elastic local morality continues.

We had few direct dealings with the Dyaks, who occupy the sub-coastal belt inland from Malays and Chinese, but outside the aboriginal core. The Dyaks are much the most enterprising race. When head-hunting virtually ended about fifteen years ago they devoted all their genius to hunting and farming, and they throve exceedingly. They are one of the few races which is multiplying, and they are spreading so that they have become a political problem; they now threaten to swamp the other and less vigorous tribes of the interior, all of whom hate and fear them.

The standard coolie wage is 40 cents a day, which works out at a little over thirty shillings a month, plus rice and tobacco (made locally). Malays and Chinese expect £4 to £7, according to their qualifications. Supplying the base camp, which in full muster numbered nearly ninety men, was a big problem, the solution of which was successfully undertaken by Shackleton. All natives eat mainly rice, with some salt fish and meat; we ate mostly rice, pigs, hens, eggs, potatoes, onions, and bananas. We managed to get over one hundred wild pigs by shooting and spearing, with the help of two brilliant hunters, Subai (a half-Dyak) and Murah, both from Long Miwah. Barking deer, rusa, and mousedeer were obtained in small numbers, perhaps twenty in all. Turtle was attempted, but it was very tough. The Kenyahs and Sěbops enjoyed monkeys, especially a leaf monkey, *Pygathrix hosei*, which was quite common and tasted very like pig. Bulwers, Argus, and fireback pheasants

Phot. A. W. Moore

Royal Kenyah women

Phot. A. W. Moore

Kenyah minstrel playing finely carved two-stringed "sapi"

Punans

Subai, the Expedition's best hunter, half Dyak and half Kenyah, with his hunting dog

were caught in long lines of snares set in gaps along an artificial hedge; hornbill was a popular native dish, but we found it unpleasant. Fish were caught in the curious native throw-nets and by "tuba-fishing," in which a part of the river is staked off and a semi-poisonous vegetable juice floated downstream in large quantities so that the stupefied fish come to the surface and are easily speared or caught in the hands. We ate somewhere near four hundred hens, mainly brought up by Chinese traders from Marudi, average cost one shilling. Pemmican and plain chocolate were found to be excellent tropical foods. Two cases of delicacies and whisky proved psychologically invaluable after a bad week. Supplies were brought up from Marudi by *prahu*, the ordinary native long boat, usually paddled by twenty or thirty men, but by us fitted with outboard motors, which gave a great deal of trouble. Floods complicated the transport system, preventing up-river travel about one day in ten, sometimes for several days on end (November). The water is often very low, but seldom low enough to prevent prahus from being poled and dragged over the shallows. There are no bad rapids on the Tinjar, but in the headstreams of the Baram and Rejang, and on the Belaga, rapids are a serious problem, and some are impassable at all seasons.

Dyak and half Kenyah, with his hunting dog

The expedition's health record was good. Ford was poisoned, probably by bad water, and had to be taken down to Marudi under morphia: he was back within a month. Synge developed septicaemia in October from poisoned leech bites while at the high camp, and had to be carried down the mountain on the backs of natives, who took turns on the ladders going down; he was treated in hospital at Miri. Unfortunately he did not recover soon enough to rejoin the expedition at the base. Leeches were very bad up to 3000 feet, and it was difficult to keep them out. Sandflies were a plague during the day, and the only way to work in the base camp was under a big sandfly net which covered one room. Ringworm, "Singapore foot," and jungle sores were common native complaints, but no European suffered from malaria (plasmoquin was taken whenever mosquitos were at all numerous). One coolie was bitten by a snake, but soon recovered under treatment. Snakes, some of them poisonous, occur. One coolie also ran amok, but was disarmed before he did any damage.

Like most pagans, all the local tribes were very superstitious. Good and bad omens can interfere with the best-laid plans, especially when an unpleasant or difficult job is on hand. Our first week in the base camp was completely disorganized by an unfortunate omen snake which was finally placated with much ceremony, hens, eggs, and *borak* rice-spirit. Spider-hunters (*Aracnothera*), which are perhaps the commonest birds in the rain-forest, are the main omens. Normally no particular notice is taken of them, but on an expedition into new country or up an unclimbed mountain, where the natives are unwilling to go, bad omens are always available and can be a great nuisance.

It was in these conditions, on the whole about as good as one could get anywhere so near the equator, that the expedition did the first part of its work, most of which was along the rivers and in virgin forest. The ornithologists had a special problem: to study life in the forest canopy. Observation posts were established in tree-tops 100 to 180 feet from the ground. A native was sent up the tree with a rope, fixing this and placing a block and tackle so that an observer could be secured in a safety belt. Thin trees were lashed to the main tree by

means of creepers wound around the trunk; to this branches were lashed crosswise to form a very crude ladder. With the rope, the ladder, and a flimsy platform in the tree-top, all was finished and ready in a morning. We made use of no elaborate devices. When a wind got up suddenly, as it often did, it was not pleasant in a tree-top post, nor could one by any means get down in a few moments. To reach one post it was necessary to walk the last few feet up a sloping branch without any ladder or handrail, only a clear view of the ground 150 feet below; the native who made the post never gave a thought to this, but we gave thought to little else during the few seconds needed to reach the other side. A boy called Awang, from the house of Long Miwah, was much the best climber; he could go up absolutely anything, at once and without fear.

The High Camp

During August a mountain camp had been prepared at 4000 feet. MacLeod and myself occupied this for the first time on August 20. The ascent on that occasion took over four hours. Later we got up easily in two and a half hours, the records up being one hour forty-six minutes (Banks) and one hour fifty-one minutes (Moore), the record down one hour twelve minutes (myself). These were all-out times, and no one tried them twice. The distance was at least 5 miles. The first 2 miles lay through high secondary forest, almost level going, but eight times crossing a small mountain stream, the Lejok, at whose mouth the base camp was placed. These crossings were treacherous at all times, and impossible after heavy rains, so that they seriously affected food transport to the high camp; for some reason we never thought to bridge them until the last few weeks, when rough log bridges were tried and proved serviceable. Above the last crossing the range rose in a series of steep ridges with an almost unbroken line of sheer cliff running for 20 miles at about 3500 to 4000 feet, with many vertical waterfalls across its face. This cliff, and many other steep parts on the ascent also, were spanned by series of ladders to enable loaded men to travel up and down. These ladders were made by felling large trees in the required position and cutting notches along the trunk; some were near the vertical, commanding terrific downward views. In wet weather all were slippery, and it was lucky that no one fell in a bad place—three people fell short distances but were not hurt. Cheap tennis shoes were found to be the best for all jungle work.

The high camp was placed at the cliff edge in a small clearing made for the purpose. It was on a smaller scale than the base camp, a two-room house for the Europeans, with one room and Malay quarters behind, and a larger single-room house for the coolies. The view from this site at certain times in the morning and evening was beyond description—you could see for more than 100 miles across the whole of Northern Sarawak and miles and miles of very little known country, to the perfect mass of Mulu, the double-peaked Kalulong, to the Kalabit country, the Hose mountains, the dome of Batu Song, and on perfect days even to the extraordinary knife-edge of Batu Lawi—all standing as islands in a sea of white cloud.

As nearly as could be judged at the time the camp was placed on the highest peak in the range, but subsequent observation from this peak, which we named Igok Peak (after a mythical animal said to roam the mountain-top and

eat solitary men, leaving only and always their hats!), showed two or three peaks to be a few feet higher, one to the south-east about 4800 feet. The range is a series of peaks distributed in a long belt with a maximum length of perhaps 10 miles. Viewed from the base camp Igok Peak appears as a central theme to a beautiful series of steps going gradually down to river-level on both sides; this is a false impression, for the range is physically a simple mountain system with a central line giving off valleys and ridges at right angles all the way. On the south side the Koyan river has cut obliquely through some of these right angles, while the slope is sandy and much less steep. From the time of first occupation onwards the high camp was never empty, and up to five people were working there at one time (three was the ideal number). Every one found 4000 feet a rest cure and mental stimulant after the sandflies and heat at river-level. But not for long. The weather routine soon got on one's nerves. In the early morning there was a perfect view. At 7 a.m. the clouds, which had held Borneo in one vast archipelago of peaks, would rise from the valley and close in upon the mountains, leaving only a cold mist in which one could scarcely see the precipice edge 7 yards away; towards dusk the clouds would roll back into the valley. On the best days this happened. On the worst days, which lasted up to two or three weeks consecutively (August), the mist and drizzle were continuous, the visibility never more than a few hundred feet. This made survey and photographic work a heart-breaking business. It was also very cold and damp at night. No coolie could stay on the mountain more than ten days, and it was found necessary to change shifts every week; even so, many men got bad colds and fevers, though we gave them all available clothes and blankets.

Transport was a serious problem. All food and equipment had to be brought up by coolies, and for this we used mainly Punans. It was necessary to keep twenty men on top for collecting, camp, and emergency purposes, which meant large quantities of rice. One man eats one *gantang* of rice in four days, and one man will carry four *gantangs* of rice (enough for himself for sixteen days), so that to keep the high camp supplied with rice alone nine men had to come up once a week. This meal-portage relationship has an important bearing on all travel in Borneo, for it is clear that without an elaborate advance organization and depot system it is impossible for any one to travel more than about fifteen days in an uninhabited area.

It is very difficult to get about above 4000 feet. At this height the high rain forest is suddenly replaced by a remarkable flora which we called "moss forest," with trees of 30–50 feet; everywhere on the ground and trees there are great festoons and hummocks of moss, pitcher plants, and orchids. The effect is quite unreal, and one is reminded of a faery woodland or a pantomime scene. The moss is often many feet thick and may cover deep gulleys and old stream-beds which are not visible from above. Any sort of movement is difficult, and everything becomes soaking wet at once. Collecting becomes very difficult indeed, but this area is of the greatest interest to biologists, having some fifty peculiar birds and mammals, a great many peculiar insects and plants, unlike anything found at lower levels.[1] We had therefore to concentrate on this zone.

[1] For a preliminary account of some climato-biological aspects of the "moss forest" see *Bulletin British Ornithologists' Club*, vol. 53, February 1933, pp. 107–115.

The Koyan

At the end of August MacLeod and I discovered an ideal camp site in a new type of vegetation, "dammar (gum) forest," at 2500 feet near the source of the Koyan river, which rises on the south side of the Dulit range, at first flows south-west, then turns east-north-east, through a divide between the Dulit and Akumla ranges, dropping 2000 feet in a comparatively short distance to join the Belaga halfway down as a sluggish river with a total length of 50 miles. In early September Banks and I went down again and passed an unpleasant night in the remains of a shelter used by dammar gatherers some years before. I decided to camp here, and with the Punans and Kenyahs made in one day a good two-roomed house, though unfortunately there were insufficient palm-leaves in the vicinity and the roof leaked in consequence. I stayed on the Koyan for a fortnight, with useful scientific results; Hobby and Ford came down later and found the place a paradise for entomologists. The camp was entirely hemmed in by trees, at the edge of a clear, raging mountain torrent with clouds of butterflies sunning on the rocks—among them many *Ornithoptera brookeana*, one of the most beautiful insects in the world.

Sub-Expeditions

As has been explained above, during the last part of our stay every member of the expedition was at liberty to go wherever he wished, provided his plan was practicable and reasonably inexpensive. Every one availed himself of this opportunity, and three trips into previously unexplored country were made.

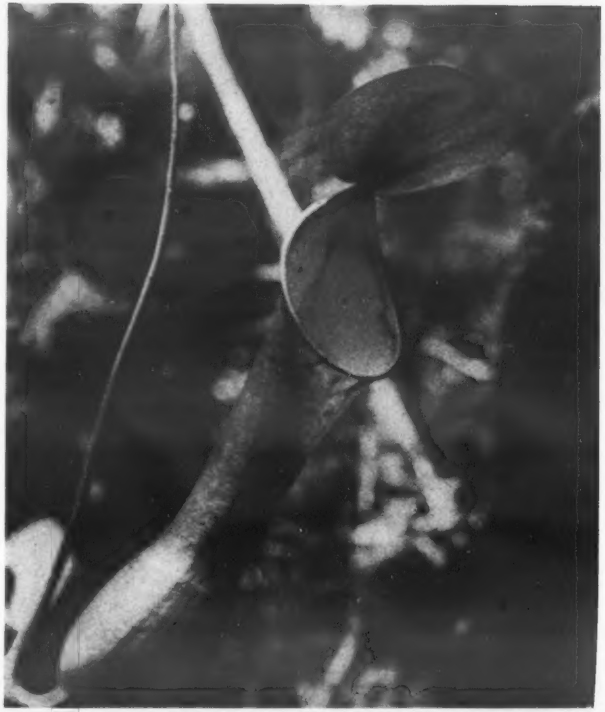
(1) *Kalulong* (E. Banks and A. W. Moore).—Banks, Moore, and sixty coolies left the base camp on October 23, reaching Long Lobang that evening; there they were held up three days by floods and did not reach Long Manian (the last house up the Dapoi) until the 29th. From here a route was known for two days up a tributary stream, the Tehani, towards Kalulong. The boats containing supplies were dragged up this and abandoned when the water became too consistently shallow and swift. A two-day reconnaisance was then made without any sign or sight of the mountain as a result. Water at this and higher levels was scarce and only enough for coolies. On November 2 a camp was made at 1750 feet on a ridge; from here Moore saw a smaller peak of the mountain and found a path believed to have been used by a Dyak following up a rhinoceros a few months before; this path stopped at 2500 feet. The coolies expressed no enthusiasm for going farther, saw a bad-omen bird, declared that there was a lake beside which ghosts dwelt between the double peak, and so on; after much delay and suitable sacrifices they agreed to carry on. Next day Moore, with a small party, succeeded in climbing the smaller peak without much difficulty and obtained a view into the Baram and over the Dulit range; at the same time some natives attempted an alternative route without success. After a day's rest a camp was made at 3000 feet, from which the Malays made valuable bird, mammal, insect, and geological collections. Banks and Moore climbed the smaller peak again, but were unable to obtain a view. Now to quote from Moore's diary:

" A party had gone out to-day (November 5) intending to find a route up the higher peak. They were to spend the night in another locality (on the

Trophy heads hanging from the roof in a Long House, Tinjar River

Graves of chiefs at Long Miri on the Tinjar

Coelogyne sp. (orchid): sweet-scented flower very common in Dulit moss forest



Nepenthes sp. (pitcher-plant): brilliant scarlet outside, inside pale green

opposite side of Kalulong to our previous camp). On November 6 I went with another party to try and ascend the higher peak. We kept at a height of 3000 feet for half an hour, passing the smaller peak on our right side. Then we began to ascend towards a saddle which was situate between the two peaks. Our first view of the high peak was disappointing, since straight in front of us stood a sheer precipice of wall, probably 150 feet high. At this time we were just below this rock face (about 3500 feet), so we were able to alter our direction without wasting too much time. We kept a sharp look out for places where there was vegetation—this made climbing easier, as the branches and roots provided good hand and foot holds. The pace was slow; we repeatedly came upon rock faces which had to be avoided, and working right round them took time; neither were we gaining much height. At one point we came to a steep slope of scree which appeared to run from about 4500 to below 3000 feet. We had to walk and crawl up this, taking great care not to dislodge the large loose rock fragments. As it was, one large fragment was dislodged, missing the native headman by a fraction of an inch. At this height the trees become smaller, the undergrowth thick and heavy, with many bamboos. The man in front had a strenuous time cutting a way through the undergrowth. A little farther on we had to cross a steep, sloping rock face, which was about 9 feet wide, running vertically down the mountain side, making a rift between the undergrowth. Once across this we climbed through the undergrowth up to the bottom of a very large rock face; we made a route alongside the bottom of this face until it ended and gave place to 'moss forest.' This moss forest was thick and dwarfed, the branches very twisted. The exposed roots afforded good aids for climbing. Another rock face confronted us, but we managed to get over the top side of it by going back a little distance and working up the edge in the undergrowth. Once in moss forest again we began climbing steadily and soon got a view of the larger peak looming ahead, about 600 feet above us.

"Between the two peaks of Kalulong is a saddle; at that moment we were at the bottom of this, midway between the two peaks and in line with them. The native headman very wisely sent a small party to make a path to the top of the smaller peak, knowing that if we could get on to that peak we would be able to use our previous path down to the 3000-feet camp—thus saving us some five hours. The rest of us directed our efforts towards the higher peak. We climbed another 100 feet of steep moss forest, then came face to face with yet another rock precipice. We took stock of the surrounding localities and saw another way up to the summit. By going back some distance we were able to get into the moss forest again. While climbing in this we heard frantic shouting from the party we had sent towards the other peak. They had seen some men on the top of the big peak—they must obviously be the party whom we had sent out the previous day, and they had succeeded in getting to the summit. Their path must be somewhere near us and it was our job to find it. We soon ran right on to it, and after twenty minutes' steep climbing through moss forest we stood on the higher peak of Kalulong. The other party had not been up long before us. The visibility had been bad, and both peaks in cloud; they had climbed the smaller peak in mistake for the larger one—a mistake any one could have made very easily. After this they had climbed the larger peak successfully, arriving there a few minutes before us. By this time a path had

Nepenthes sp. (pitcher-plant): brilliant scarlet outside, inside pale green

Coelogyne sp. (orchid): sweet-scented flower very common in Dulit moss forest

been made successfully up to the smaller peak. We descended into the dip, up this path to the peak and down to our 3000-feet camp in two hours."

On November 7 they reached the boats again and thence travelled downstream without incident, reaching the base camp on November 11. The whole trip took eighteen days, a remarkably short time; but two or three more days would have made the final climb impossible as the party could not carry sufficient rice. The trip was in the nature of a lightning raid, and it would appear to be quite impracticable to stay for long periods collecting or surveying on Kalulong. The total cost was about £60. Kalulong has not been climbed before by native or European. The collections show close biological affinities with Dulit, and are of much interest.

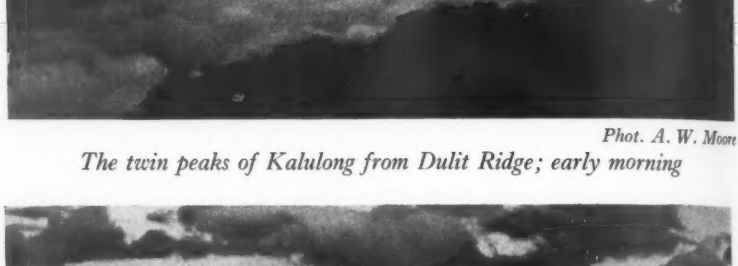
(2) *Belaga-Rejang* (T. H. Harrisson).—I left the base camp with Banks and Moore, separating from them a day's journey up river, where I took the right branch and they the left. I travelled for two days up the Lobang in bad water conditions; we had to take all baggage out of the boat at several rapids, and all the way there was fast water. On the third day we met Taha, the Malay surveyor who had been linking up the Tinjar with the Belaga by compass traverse. We started overland along a path between the Tinjar and Belaga, used occasionally by Dyaks from the lower Rejang who came over into the Tinjar and Baram after rhinoceros. Going was bad owing to heavy rains and the many streams crossed by the path (every few hundred yards): several of these were high and at two we had to build rafts for the baggage. Early on the second day's walking we crossed the watershed, which is just over 2000 feet at this point; the Dulit range had previously been considered as continuous at and above 3000 feet right away towards Dutch Borneo. This pass means that there is no montane barrier for fauna and flora between the Tinjar and Belaga rivers, a fact which has considerable biological significance.

The crest of the watershed was decorated by an elaborate arch of omen symbols and two particularly fine wooden figures which were as usual made to placate the spirits on the mountains. The descent on the south side was rapid, and in two hours we reached the Belaga. Five men immediately left for the nearest long house to fetch a boat (which appeared within thirty-six hours) and to send messages down river to prepare the other house for our visit; a nucleus remained to collect birds and mammals. Six of the coolies were Kenyahs from Long Atun on the Tinjar; this house was originally situated in the Belaga, one of the headquarters of the Kenyah tribe, but was destroyed by Dyaks thirty years ago and moved to its present position. In addition to the rare and unexpected visit of a white man we were particularly welcome because these Kenyahs had an incredible quantity of relatives in the Belaga houses. We reached Rumah Pawa, the last upriver house (incidentally the richest I have seen), on October 28 and were the occasion for a three-day celebration on typical Kenyah lines. I stayed at three houses on the river, which is about 20–30 yards wide and rather sluggish in this area, with the 3000–4000 feet range connected with Dulit running gradually away to the south-west on the right bank; on the left there are minor hills only. At Long Meja, which is about a day's journey below the point where the Koyan joins the Belaga, I was held up two days by floods, which were not nearly so bad as my kind hosts made out, but on the third day I insisted on leaving, flood or no flood. The last

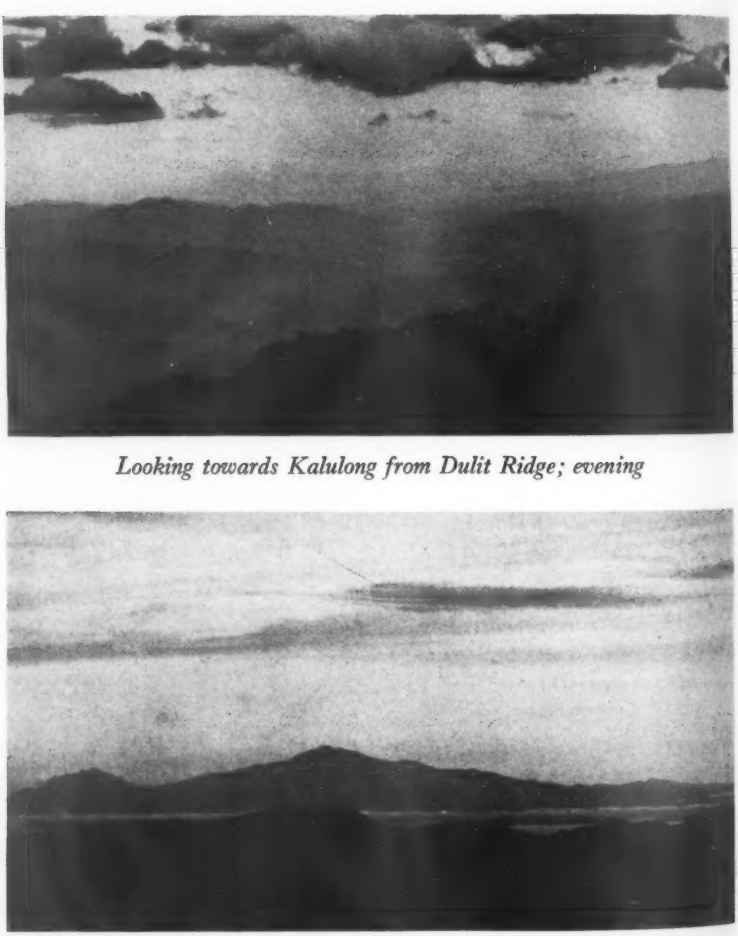
Looking towards Laiun range from Dulit Ridge

Phot. A. W. Moore

The twin peaks of Kalulong from Dulit Ridge; early morning



Looking towards Kalulong from Dulit Ridge; evening



Mount Mulu, 60 miles distant, seen from Dulit Ridge

30 miles of the Belaga is broken up by a series of rapids, probably the worst in Borneo, and impassable at all times. It is necessary either to arrange for a boat to wait at the foot of each rapid or to go by foot all the way. There is also an overland route from the true right bank at the first rapid through hilly country for two days to Kuala Belaga, but I did not try this. In order to visit every house we travelled all the way down river, and on November 2 arrived at the junction of Belaga and Rejang, which latter is well over a month's paddling from mouth to source. There we stayed five days in the old fort, where we gave a great party at which thirteen tribes and races were present.

I had previously sent half the coolies back up the Belaga to return the prahus we had used between the rapids. With the remaining Kenyahs and Sĕbops I travelled for a day up the Rejang and then up a small tributary, the Mejawa. From here we struck overland. I managed to get two Kayans who said they knew the way across. The first day, after travelling hard for six hours, we were surprised and excited to come upon footmarks which the Kayans declared to be those of nomadic Punans who roam this area; closer investigation showed the footmarks to be our own, and proved that we had made a complete circle. After this I travelled the whole time by compass, for though there was no map it was possible to calculate from bearings I had taken on the Belaga and Rejang the general direction of the Dulit range. For four days we travelled from dawn till night by compass north-north-west through dead flat virgin forest, crossing many rivers and small swamps where pig were abundant and easy to shoot. On November 12 we struck the Belaga within 3 miles of the last house, Rumah Pawa, where this second surprise visit from an unexpected quarter led to a celebration which delayed our departure two days. Next day we left for the headwaters and thence across the watershed again, reaching the base camp on November 16, after a month's travel, in which we had covered about 250 miles. Every one was much the worse for wear and some of the coolies (especially Kenyahs) suffered badly on the overland journey from the Rejang; a few days' rest put everybody fit again.

(3) *Mount Mulu* (E. A. Shackleton).—Shackleton left the base camp on October 26 and spent a fortnight preparing plans and stores in Marudi. A summary of his narrative runs as follows:

"Three days up the Baram and Tuto brought my party, which included a Dyak ex-policeman (Serjeant Dian) and a Chinese-Malay boy, on November 9 to Long Malinau at the junction of the Tuto and its tributary the Malinau. Between these two rivers lies Mulu. The highest mountain in Sarawak, it had previously defeated all attempts to penetrate beyond the foothills, although Ernest Hose and an Oilfield's geologist are reputed to have reached considerable heights. About ten years before a native, one Tama Lilong, while trailing a rhinoceros, had found a way on to the main south-western ridge of Mulu. He guided my party through the cliffs and up the same trail so skilfully that we had not one single rock face to climb. With twenty coolies and five boats we started on November 11 up the Malinau and then up a small tributary until further progress was blocked by fallen trees. The next day's march took us along the course of the stream past the cliffs of Gunong Api (Mountain of Fire), which rise steep for nearly 2000 feet. Near here we came across hot sulphur springs (110° F.), an interesting discovery; we reached the mountain foot at

dusk. Two days later we attained the first peak, 5100 feet, and camped on the other side at 4900 feet, well within the moss forest (which begins about 4000 feet). Going here was very bad; it had been raining twelve hours in every twenty-four. This main south-west ridge leads up to the second peak, 5800 feet, where the fifth camp was pitched, from which we had a wonderful view of the western mountain ranges against the setting sun.

That night the natives held propitiation ceremony to prepare the way for the ascent of the peak, which I saw clearly for the first time since leaving Dulit. We then followed a trail along the same route, through the deep moss forest; in places we had to cut a way through walls of moss, but on more exposed ridges the moss almost disappeared and the stunted trees were not over 12 feet. We camped at the foot of the main peak, which was the farthest point so far visited by the natives. On November 17 a small party quickly cut a way to a height of over 7000 feet across dangerous ground, as in places we were walking over the top of rotten vegetation, or over bridges of moss with once or twice a concealed drop hundreds of feet deep below us. The last 700 feet took us over three hours, owing to the difficulty of hacking at the matted bushes from an insecure foothold. As we got nearer the peak the mountain-side became steeper, till just before the summit we were scrambling up a perpendicular wall of moss and broken branches. After our arrival heavy rain fell, soaking everything, but conveniently forming puddles which provided us with a very necessary and otherwise non-existent water supply. During the night the temperature fell to 54° F., and it seemed bitterly cold. The next morning we had a brief glimpse of the sea towards Labuan, and some distant ranges stood up through the mists below us. Just before a hurried return owing to food shortage, another peak was observed on the same ridge, and an hour's cutting brought us to this, the real summit, 7950 feet by aneroid, where we deposited a note in a bottle within a small fire clearing. These fire clearings are rather interesting as they occur frequently along this top ridge, and have apparently been burnt by the sun. The average height of vegetation was not above 7 feet and on the actual peak 4 feet.

"A rapid descent brought us back to our camp below the main peak at 6000 feet, and next day by forced marching through intermittent rain we knocked three days' journey into one. Rice supplies were now exhausted, but enough pemmican was left. We managed to make a collection of plants, mosses, and lichens on the way down. Early next morning we reached our rice depot near the foot of the mountain, and that evening reached Long Malinau, bringing with us all our plants and a few insects and birds. We received a warm welcome from the chief of the river, Penghulu Tama Tinggan Maling, who had done so much to help us."

The climbing of Mulu was a considerable achievement. Shackleton considers any large expedition as quite impossible, owing to great transport difficulties and water supply. A single individual might be able to work on the summit for a short time in the spring, but a tent would be necessary, and there is a serious risk of fire. The mountain is of great biological interest, and it is very probable that new birds, mammals, etc., would be found near the summit.

The great limestone faces to the south-west (and probably round to the north) of Mulu make it unlikely that there is a better route to the summit. The

neighbouring mountains, Gunong Melerate, 5500 feet, are all surrounded by precipitous limestone cliffs and appear quite unclimbable.

(4) *The Baram and Lake Bunoh* (C. H. Hartley).—Hartley elected to spend the last month living among the Kayans in the Baram. He spent three weeks at Long Laput, where he had a very interesting time, was able to see and write up every stage of a ritualized head-hunting, and was before his departure christened with full ceremony with the native name of Batu Wan. He also made collections and investigations in the remarkable birds'-nest caves on the Baram, where vast numbers of esculent swifts breed, and bats live in millions. On November 17 he returned to Marudi, collected fresh stores, and left at once for lake Bunoh, which lies up the Tru river between Baram and Tinjar; this lake (one of the few on Borneo) is very rich in animal life, and interesting observations and collections were made.

(5) *Tinjar Headwaters* (J. Ford and B. M. Hobby).—Ford and Hobby left camp on November 2 and spent ten days in a round trip of all the houses in the Tinjar headwaters. They went by prahu up the Lobang and Nibong, by foot across to the Burroi, and by prahu again down the Dapoi and Paung to the Tinjar. All the members of the expedition were by this time known personally to almost every native, so that Hobby and Ford were fêted at each house. They were able to take many interesting photographs and witness some remarkable new dances and games.

(6) *Gunong Laiun* (P. W. Richards).—Richards stayed on at the base camp in November, but made a short expedition up the Balapau river to Gunong Laiun, the 3800-foot mountain on the opposite bank of the Tinjar to Dulit, and the highest land dividing the Tinjar and Baram rivers. He found moss forest on the top ridge and botanical results were very satisfactory, as there were at all heights large numbers of species not met with on Dulit.

(7) *Niah Caves* (P. M. Synge).—Synge came out of hospital after a poisoned foot too late to rejoin the expedition at the base camp. He therefore went by sea to the Niah birds'-nest caves, the finest in the country, a day from Miri. He spent a fortnight there photographing and doing an ecological survey of life zones in relation to light intensity within the cave; he also collected orchids, fungi, and other plants.

Scientific Appendices

A general paper bringing together the trends of all our papers is projected when all the specialist reports are published. We are also publishing, under the title "Borneo Essays," eight contributions on the geographical, political, social, and other aspects of our stay, one contribution by each member of the expedition. Detailed files of the expedition and a set of photographs will be filed c/o C. S. Elton, University Museum, Oxford, where they will be available for reference.

A. *Survey*. By E. A. Shackleton

It was only recently that a Government Survey Department under Mr. C. N. Middlemas (who gave us every help both before and during our stay) was organized to carry out a thorough survey of Sarawak. Rather than attempt to clear up the muddle of previous maps a start was made on a triangulation scheme. A base line with an error of less than 1 in 1,000,000 was measured near Kuching, the capital, and the triangulation has now progressed a considerable distance; it will however be some years before it is carried through to join on to the triangula-

tion in British North Borneo. Hitherto all maps of Sarawak have been compiled from an unreliable mixture of sources.

Sarawak Oilfields, Limited, in the years before the war sent their geologists and native surveyors up many rivers, and attempts have been made to fix the general formation of the mountain ranges. They also made an aerial survey along the flat coastal belt in the oil-bearing areas. The Government have the right to all maps produced by Sarawak Oilfields geologists, but owing to the constantly changing staff of the latter this plan is not fully operative, and the Government would do well to ensure closer co-operation. The only maps obtained previously for general purposes were those made by Charles Hose (1880–1890). These are simply sketch-maps, and are based on a mixture of compass bearings and hearsay. Though many of the places and mountains are wrongly named and very wrongly placed, it still remains as the only map which begins to show at all the extremely mountainous nature of the country, as well as giving interesting information about tribal distribution of natives and the presence of such physical features as bad rapids and waterfalls, from which it is always possible more easily to visualize the nature of the country. Doubt however may be cast upon the morality of drawing a sketch-map, as was done for Hose's R.G.S. paper (*Geogr. J.*, vol. 1 (1893), pp. 193–208), fixing it in a map projection, and then measuring off the longitude and latitude of places to within seconds, when there was an error of over 20 miles in the position of his own residency. Hose's mountain heights were also pure guesswork; some are over 2000 feet out. The official map of Sarawak, published in 1931, is an unpretentious affair, showing the triangulation work up to date, but in addition several larger scale sheets have been produced showing the triangulation and river surveys of the first three divisions.

One of the chief duties of the expedition surveyor was to assist the other scientists of the party in giving the height at which their specimens were collected. The dense forest prevented anything except the summit of Dulit from being fixed by trigonometrical methods. A chain of aneroid heights was therefore carried up the mountain-side and stations were marked by which collectors could estimate the altitude. A series of readings gave a final height value to Igok Peak of 4600 feet, the mountain camp a value of 4000 feet. The camp on the Koyan river was computed at 2500 feet. The diurnal wave, which was very regular, had an average range of about 0·15 inch, reaching its lowest point between 3 and 3.30 p.m., usually just about the hottest time of the day, which was frequently succeeded by a thunderstorm and the regular afternoon rains. The position of the camp was lat. 3° 18′ 53″ N., long. 114° 17′ 23″ E., fixed by a series of star observations, three pairs east and west, three pairs north and south. These few represent the better part of three months' waiting for clear skies. On very few nights indeed were stars seen; even then the sky was only partly clear. The observations were obtained within two hours of sunset; for even on the rare cloudless nights a heavy mist always closed in shortly after 8 p.m. A large number of sun observations were taken as checks; these were not difficult, and gave surprisingly accurate results, agreeing within 0·2 of a second of time with the value obtained from star observations. An efficient wireless set was essential for astronomical purposes. We used an Eddystone All-Four Short-Wave receiver lent to us by Messrs. Stratton, and Ever-ready batteries lent by the makers. We took regular time signals (also concerts) from San Francisco, Kavite in the Philippines, Malabar in Java, and various European stations. The International Short-Wave Club also sent messages to us from America.

A river base was measured by subtense as part of the river survey, and by this means points on the Dulit range were fixed. No serious attempt had previously

been made to map the mountain ranges, and a series of hill intersections were made from the top camp and from Igok Peak—half a mile to the south-east. The alleged positions of mountains were often found to be miles out, and the whole map had to be shifted to bring it into correct relation with fixed positions at the base camp and Marudi. The difficulties of work from the mountain-top were considerable, the chief obstacle being the almost continuous rain and cloud with which Dulit was surrounded. Ordinarily the distant peaks, such as Batu Lawi, Mulu, and Kalulong, were visible only at dawn before the clouds had risen from the valleys. In addition the densely clad mountain tops precluded any accurate intersection and the depth of the moss on the summit prevented steady levelling. Even the slightest movement by the observer upset levelling; not even by the use of 4-foot stakes driven into the moss was this difficulty overcome. During the first part of the mountain work we had the services of C. N. Hammond, of the Sarawak Survey, but at that time (September) the weather was so bad that very little work was possible. Not until a fine spell in mid-October was a complete series of intersections obtained, but we were then able to observe, in addition to the innumerable ranges in north Sarawak and on the Dutch border, many peaks to the south-east and south-west in hitherto unknown country. The name question presented difficulties as we were often unable to point out to the native who was giving the information the actual range or peak amid the confusion of mountains. Reliable informants often attached different names to the same peak, and the only sure method is to take the name used by the people (if any) living nearest to the range in question. The names on Hose's maps are similarly unreliable.

The Malay surveyors lent to us by the Government were quite competent. One, Junit, was engaged on the river subtense, which he successfully took down 125 miles as far as Marudi (S.O.). A less highly trained man, Taha, surveyed special areas around the camp according to the wishes of the biologists, and was later engaged in mapping (by chain and compass, or by range-finder) the headwaters of the Tinjar and its tributaries. In addition he took connections overland to the Baram river and to the Belaga, which latter path was followed by Harrisson at the beginning of his expedition down the Belaga to the Rejang (in November), where he did time and compass surveys. Moore and Shackleton also completed journeys in unexplored country, and both managed to produce maps of their travels by rough compass traverses.

B. *Meteorology*. By P. W. Richards

In Sarawak the south-west monsoon blows from April to October and the north-east for the rest of the year. The period of the north-east monsoon is usually considered the "wet season," but actually the rainfall is fairly evenly spread through the year. As we were at Mount Dulit from the beginning of August till nearly the end of November we were able to sample both types of weather.

Meteorological observations were made at both the Base Camp and the High Camp, but it was impossible, owing to pressure of other work, to keep continuous records at either for the whole period of the expedition.

At the Base Camp temperature and humidity were constantly high. The daily maximum temperature averaged 88° F., but was 4–5° lower in rainy weather; the average minimum was very constant at 73° F. Humidity was always near saturation at night, but fell to about 60 per cent. on sunny days. At 4000 feet the climate was much cooler, the mean temperature being about 10° F. lower than at the Base Camp. The daily range of temperature was greater; the mean maximum was 79° F., the mean minimum 63° F. In spite of the general impression

of extreme dampness, the humidity frequently fell to 90 per cent. at midday: on one very warm, dry day in September 39 per cent. was reached. Though mist and rain are the characteristic features of the mountain climate, dry spells do occur and cause a considerable drying up of the moss forest.

C. *Photography*. By P. M. Synge, B. M. Hobby, and A. W. Moore

Over six hundred good negatives were obtained, including pictures of animals, orchids, rivers, mountains, and cloud views, floral zones, native parties, and a complete record of all natives who worked for us. Synge, the official photographer, used a Soho Reflex ¼-plate tropical camera with Dallmeyer Pentac F/2·9 lens and a Ross Teleros F/5·5, 13″ lens; and a 2¼″ × 3¼″ Etui camera with Zeiss Tessar F/4·5 lens. Ilford Special Rapid backed Panchromatic plates were satisfactory (film packs tended to jam). Hobby and Moore used a Voigtlander F/4·5 and a Nagel F/6·3, ordinary 2¼″ × 3¼″ models, with anastigmatic lens; ordinary Kodak No. 120 roll films were found better than Verichrome in which the backing stuck to the negatives. Dallon and Kodak tanks and Tabloid tancol were used for developing, which was done on the spot; sodium sulphate, 10 per cent. by weight in the developer, followed by a bath of chrome alum for ten minutes, were used as hardeners. Drying was very difficult, and many negatives were injured by dust and foreign matter in the air; it was found best to hang films (securely fixed against wind) for twenty-four hours in the roof rafters of our camp. Kodak negative albums were used for storing, and plate negatives were sent back to Singapore as often as possible. In the open F/16 was found best; mountain views on clear days required ½ second at F/11 (with heavy filter), on misty days 1–2 seconds at F/16; in the rain-forest 6–10 seconds at F/22.

D. *Geology*

Though no official geologist was attached to the expedition a number of geological specimens were obtained on Mount Kalulong and elsewhere in new country, and will be reported upon by Dr. Bayzand, of the Geological Department at Oxford. The Tinjar and Baram areas have been fully investigated by the geologists of Sarawak Oilfields, Limited.

E. *Zoology*

(i) *Mammals*. By T. H. Harrisson

Mammals were numerous, and about 350 specimens were collected, mainly from the peculiar faunal zones above 3000 feet. Squirrels are the dominant group, being represented by thirty-six species, including flying squirrels, tree-top squirrels, and ground squirrels, the smallest 3 inches and the largest 3 feet long. Several new squirrels were obtained, among them a flying squirrel unlike anything previously known in Borneo. Special attention was paid to the exact distribution of *Sciurus prevosti*, which appears to be represented by distinct races in almost every river and mountain system in Borneo. Monkeys were abundant in numbers but not in species. Only gibbons, macaques, and a leaf monkey were encountered; the leaf monkey provides a curious problem in that there are three closely allied *Pygathrix* species, which recent writers have attempted to prove are only dimorphic phases of *Pygathrix everetti*. Our evidence does not support this view and suggests that *Pygathrix hosei* and perhaps also *Pygathrix sabanus* are specifically distinct from *everetti*. The very interesting and primitive tree shrews (*Tupiaidae*) were represented by thirteen mountain and lowland forms, feeding on or fairly near to the ground. Civet cats, including the rare *Hemigale hosei*, wild cats, and mouse deer were caught in snare-line hedges. Wild pig were common in the forest, but buffalo and rhinoceros very rare and

local within the area covered by the expedition. Hartley made large collections of bats in the Baram caves, and no doubt among them are a number of forms new to science. The soft parts, gonads, and food contents were examined in all specimens collected, and parasites taken where possible. The general collections will go to the British Museum of Natural History. Topotypes of any new forms that may be described (especially bats) will be sent to the Raffles Museum, Singapore, and a part of the collections to the Kuching Museum, Sarawak.

(ii) *Birds.* By T. H. Harrisson and C. H. Hartley

Incidental to observational work 1050 birds were collected, at all levels from the river to Igok Peak, and in many parts of the Baram and Tinjar river system. A number of new forms will shortly be described by us, and we expect to describe others in the future. The habitat and mountain zonation were worked out in detail. Two species only were common to virgin and rain forest, paddi clearing, and all the types of secondary forest between these extremes; on the other hand, only three species were peculiar to the clearing and about five to secondary jungle. The rain forest is the primary ecological unit, and the population in other habitats is simply a section of that in the rain forest. Many birds are confined to the rain forest. Five lowland species were found in the moss-forest zone (above 4000 feet), but no mountain species go down to the lowlands.

As has been described above, tree-top stations were established in the forest canopy. Observations from these proved that there was no particular canopy bird fauna and that there was little or no activity in the canopy between 8 a.m. and 4 p.m., all birds moving down into the sub-canopy during the heat of the day. There was no sort of distinct stratification of bird life in the forest, a conclusion also reached by the botanists; the statements to this effect in most popular and scientific books stand in need of revision. Three groups (spider-hunters, broadbills, sunbirds) were breeding during our stay; most others had finished shortly before our arrival (*i.e.* in July). "Territory" was observed only in spider-hunters and trogons; and it was curious that mixed flocks were conspicuous only by their absence. Special studies were made on the habits and the mythology of spider-hunters (*Aracnothera*)—the chief omen birds of Borneo, on the food of broadbills (*Eurylaimus* and *Calyptomena*), and on song periods in *Trachycomus*. Hartley undertook a detailed study of the esculent swifts in the bird caves on the Baram in November. Notes were made on the soft parts, gonads, and food of all specimens collected. The main bulk of these collections will go to the British Museum (Natural History), duplicates and topotypes to the Singapore, Leyden (Holland), and Kuching Museums.

(iii) *Reptiles.* By T. H. Harrisson.

We made a fair collection of snakes and lizards, mainly below 3000 feet. These will be reported on in due course.

(iv) *Insects.* By B. M. Hobby and A. W. Moore, assisted by J. Ford

Nearly twenty thousand insects were taken, most orders being represented—Hemiptera, Coleoptera, and Diptera the most numerous. A number of species are very common and widely distributed, but there are an enormous number represented by very few individuals. Representative collections were made in the different habitats and mountain zones. The primary sand forest at Marudi had a very distinct fauna, unlike anything in the Dulit area. The open clearings with one or two years' growth of vegetation had a fauna quite distinct from that of the forest (*e.g.* Ascalaphids, grasshoppers, butterflies, Asilids). The primary forest in the Kapah river, half a mile below the base camp, had certain affinities

with the old secondary forest at the foot of Dulit, but many species were not common to both areas although they were near one another and at the same altitude. The primary forest on the Koyan (2500 feet) had affinities with the Kapah, but was affected by an influx of forms from moss-forest levels. Many common lowland forms were found in the moss forest (above 4000 feet) although they were outnumbered by specialized high forms, which do not occur at lower levels. High forms occurred much lower on the Koyan than on the base-camp side of the range. Collections made on Mount Kalulong in November showed affinities with those made on Dulit, but quite a number of species not common to Dulit were obtained. Light traps were suspended at 80 feet up in trees; they yielded a greater proportion of leaf-hoppers than did traps suspended at lower levels; leaf-hoppers were the most abundant insects caught in the tree-tops, excluding winged ants and termites. Special studies were undertaken on zonation of cockroaches, and on the Asilidae (Hobby) and wood-boring beetles (Moore). The collections will go to the British Museum (Natural History) and sample collections to the Hope Department at Oxford and the Sarawak Museum, Kuching.

(v) *Other Animal Groups.* By J. Ford

On an ecological survey of the Lejok river from the base camp to the high camp all macroscopic aquatic invertebrates and fish, as well as arthropoda and amphibia associated with the river habitat, were collected. The common factor in all groups was the presence of special adaptations to resist the rapid current and sudden violent floods. All insect larva, tadpoles, adult frogs, etc., were able to cling by suckers or similar mechanisms to rocks and stones. General collections (about four thousand specimens) of Annelidae, Mollusca, Arachnida, Crustacea, Scorpions, Myriapods, and Amphibia were made at all levels in the forest, though some groups (such as Mollusca) were difficult to study owing to the immense amount of available cover.

F. *Botany.* By P. W. Richards and P. M. Synge

The collections included 1230 flowering plants, 277 ferns and lycopods, 524 bryophytes; including several large gatherings of liverworts for distribution in F. Verdoorn's *Hepaticae Selectae et Criticae* (Utrecht), 24 algae, 72 lichens, 351 fungi. Very full data were obtained on all forest trees in connection with a possible future volume on Sarawak trees in the 'Forest Trees and Timbers of the British Empire' (Clarendon Press) series.

The main object of the ecological work, which was under the direction of Richards, was to get data for comparing the Bornean rain forest with the area of rain forest in British Guiana studied by the Oxford University British Guiana Expedition in 1929. The Sarawak forests, like those of Guiana, were not homogeneous, but could be divided into several types.

Almost all level or moderately sloping land has at some time been used for growing rice: the abandoned rice fields are occupied by second-growth forests, called by the Malays *jerameh* or *belukar*. Elsewhere there is a primary forest or *hutan tua*. It was of great interest to find that in Sarawak, as in Guiana, the primary forest was not homogeneous, but could be divided into different types. On heavy soils there was a mixed type in which Dipterocarpaceae formed about 40 per cent. of the larger trees, though no one species formed as much as 5 per cent. On white sand in the Koyan valley and near Marudi there was a peculiar type of forest similar to the "Heath Forest" (*Heidewald*), described by H. Winkler from Dutch Borneo. This was of special interest, as it showed an astonishingly close analogy in all details of structure and general appearance with the Wallaba

forests of British Guiana: in both there is a tendency for a single species of tree to become dominant.

Above about 3800 feet the mountains in the Dulit area are covered with "moss forest," which is entirely different from the lowland rain-forest and has hardly any species in common with it. The trees are low and crooked and never have buttresses; the lower parts of the trunks are thickly covered with hepaticae. A striking feature of the "moss forest" is the sharpness of the boundary between it and the lowland rain-forest. A similar type of forest is known to occur on high mountains throughout the Indo-Malayan region.

Among special studies undertaken was the collection of a great many leaves in order to investigate stomatal frequency; Synge was especially concerned with orchids and pitcher-plants (including the magnificent *Nepenthes veitchii* and *bicalcanta*): large numbers were collected for Sir Jeremiah Colman's collection at Gatton Park, Surrey. The first set of plants will be kept at the Royal Botanical Gardens, Kew; a duplicate set of trees will go to the Imperial Forestry Institute, and the remaining sets to the British Museum, Singapore Botanic Gardens, Kuching Museum, etc.

Summary

The Oxford University Sarawak Expedition, 1932, spent three months in a detailed ecological investigation of the Mount Dulit area in Central Borneo, especially studying mountain and habitat zonations. Incidental to this work 1000 birds, 350 mammals, 50 reptiles, 20,000 insects, 4000 other invertebrates, 2500 plants, and over 600 good photographs were obtained. Each member of the expedition, as well as the general work, had one or more special scientific problems of his own. A large amount of observational and systematic material has been obtained. The whole Tinjar valley was surveyed and many mountain ranges and peaks were observed for the first time. During the last month smaller units travelled over a wide area. Shackleton climbed Mulu (7950 feet), the highest mountain in Sarawak; Banks and Moore climbed Kalulong (5500 feet), probably the most inaccessible mountain in Sarawak; Harrisson crossed into the Belaga and thence down to the Rejang, returning overland by another route. Other members of the expedition undertook lesser journeys in better-known areas, and made many observations on the social life of various tribes as well as obtaining biological data and collections.

The expedition's plan of work proved a success; the objectives planned before leaving England were attained and a number of other hopes realized. Health was good, and every member of the expedition was reluctant to leave for civilization when the time came to do so.

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DISCUSSION

Before the paper the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: The Oxford University Exploration Club was really the outcome of Mr. Binney's expeditions of 1921, 1923, and 1924. The moving spirit of that club, in its inception and since, has been Mr. Elton, a well-known biologist, who has been its Chairman and has now taken the post of permanent Treasurer. Mr. Shackleton has now become its Chairman, Mr. John Buchan its President, and Dr. Longstaff is one of its active members. So that it may well be considered to be a strong organization. The Club has sent expeditions to West Greenland, to British Guiana, to Hudson Straits, and to Sarawak, and they are sending another expedition to Spitsbergen this year. They have combined very special biological work with the purely geographical work that they have carried out.

To-night we are to hear of the expedition to Sarawak, on which they made a detailed scientific survey of the Dulit area, which is in the centre of the island of Borneo. The expedition was led by Mr. Banks, who is still in Sarawak, where he is the curator of the Kuching Museum.

The lecture to-night will be given by Mr. T. H. Harrisson, who organized the expedition in England under the general supervision of Mr. Elton, and was himself the principal ornithologist of the expedition.

Mr. Harrisson then read the paper printed above, and a discussion followed.

The PRESIDENT: Mr. Hartley is the youngest member of this not very old company; in fact, I think Mr. Hartley left Eton in order to go on the expedition. He was the assistant ornithologist.

Mr. C. H. HARTLEY: When the expedition of biological survey was at an end in November, I felt I should like to combine a certain amount of not too serious ornithology, having had some during the past two months, with an opportunity of seeing real native life, which was slightly different from that affected by our insidious influence, such as gramophone, clothes, and so on. I was lucky to be able to get to a log house on the Baram, which was in the centre of the best cave district, and which also is the largest house in that particular division. I think it was over a quarter of a mile long; anyhow, it took me ten minutes to walk from one end of the veranda to the other. I was there for three weeks altogether, and for about the first ten days was busy looking at all the caves. None there is very large, but they produce a better type of nest than any other caves in Borneo. The nests are absolutely pure white, whereas usually they contain a certain number of feathers or moss, mixed up with a good deal of saliva, of which the birds make their nests.

The district officer had asked me when I went up there to try to make some estimation of whether the birds were decreasing, because the natives are very unscrupulous. They can sell the nests to the Chinese for large sums, so they are continually taking them. Under the old system, whenever they wanted money they went out and helped themselves to nests. Naturally that would lead to a

falling off in the number of birds. Unfortunately, the natives got to know what I was endeavouring to find out and they pitched me an extraordinary story about how the nests had been eaten by bats. I made a very large collection of bats: they were not at all difficult to get. The only trouble was that having fired a gun once in the cave the place was full of bats which flew round one for the next ten minutes. It was necessary to put out the light and to cover one's eyes. Eventually I came to the conclusion that there was nothing in it, though the natives did produce one or two nests which had obviously been eaten by something, whether specially prepared for my benefit or eaten by a rat on the floor I do not know.

That took about ten days, and I had five left. When I first arrived at the house the natives were anxious to know how long I was going to stay, because they had a great ceremony coming off and they rather led me to understand that I was not going to be present. They ultimately relented and I was able to see the ceremony of going out of mourning. One of the aristocracy of the house had died and the whole house was officially in mourning, which meant there were various things they might not do. They might not wash; they were not allowed to cut their hair or shave, the consequence being that they had long hair, one of the things Borneo natives hate.

Before going out of mourning it is essential that they shall have taken at least one head. Of course that is not legal now, so they have invented a way of getting round it. They either borrow a skull from another house or smuggle one of their own skulls out and pretend that they have taken it. The selected natives who are allowed to have taken the skull all spend the night in the jungle, and early in the morning all the men in the house who are old enough to walk go out in boats. They go up-river, and there is a great ceremony in which each man solemnly draws his *parang* and deals the skull a smart blow, after which he is considered to have taken the head. They allowed me to see everything.

The rest of the day is taken up with ceremonial dances and a considerable amount of drinking. About 6 o'clock the second half of the ceremony takes place, when they assemble in front of the chief's house, where all the skull trophies are arranged, and give them food and drink, which consists of sharpening small bits of stick and fastening a piece of mud on each bit of stick; the natives then go along the line of heads sticking these bits of stick into the eyes and pouring a little of their liquor over the skull. There was a somewhat amusing incident. There had been a good deal of drinking, and the chief had taken too much. He got about halfway down the line of heads and absolutely refused to go on. He said it was all complete nonsense. After about half an hour the house was entirely disorganized, because in the view of the natives the chief's behaviour was the worst thing that could possibly happen. The heads would, they thought, immediately turn on them. Eventually the chief's wife "went for him," and after about three minutes he was back at his job again!

After I had been present with them at their ceremonial the natives were very anxious that I should be christened officially, and this they proceeded to do. As far as I can make out the main part of the ceremony is that everybody has an immense piece of pig. I had to provide the pig! But the interesting point in connection with the ceremony is that they never eat pigs normally; they save them up for such occasions. They take out the liver, which is one of the most important omens. My liver, whether cooked or not, was considered to be extremely favourable. It was pronounced absolutely certain that I shall go back to Borneo. I can only say, in conclusion, that I have every intention of doing so.

The PRESIDENT: I am sure every one, not only in this audience but in the whole Society, would desire to give a most special welcome on this platform to

the son of Sir Ernest Shackleton, who went with the Oxford University Exploration Club's Expedition to Sarawak. I ask him to add a few words.

Mr. SHACKLETON: I should first like on behalf of the Exploration Club and also on behalf of the other members of the expedition, to put on record our thanks, and also our pleasure, in going on an expedition which was under the leadership of Mr. Banks and Mr. Tom Harrisson. Personally, Mr. Banks did a tremendous amount of work on the expedition. He helped us enormously with the natives, and took immense care, especially when any members of the expedition were ill. I should like him to know that we really do appreciate all he did for us. Tom Harrisson organized the expedition: I might say he executed it as well. He really did a great amount of hard work, and the success of the expedition is a credit to him.

There is something he did not include: an account of his own particular exploration. You will have gathered some idea of it when he said he was lost for five days. In fact, he did a very difficult journey across unknown country. He had not the excitement of climbing a mountain, so in some ways his journey was more creditable.

Mine was a half-time job. I had to help with the organization of the Base Camp, more especially when Banks and Harrisson were not there. In addition, I was the surveyor. One of the chief difficulties with which I had to contend was the social habits of the natives; for I found that whenever I went out to take my sun observations they nearly always seemed to choose that time of the day to visit the camp, with unfortunate effects on the reliability of my observations.

Another difficulty we had to contend with was continual cloud. At night this used to fill the valleys so that it was impossible to get any sort of view of the stars except just a short time after sunset on very special nights. When we were surveying from the top of Dulit we had to get up early in the morning, and we had another special difficulty there in the depth of the moss. It was most difficult to level the theodolite and keep it steady.

The moss was one of the most interesting things, at any rate to me. I am not a botanist, and so I do not know a great deal about it, but when I was on the trip up to Mulu I came across the most extraordinarily thick moss; and in places, especially over the 5000-foot level, we found the moss was so deep that the mountain seemed to disappear. I used to carry a staff so that if I fell through, which I used frequently to do, I always stuck before going far: the stick would catch in the roots and moss. I suppose the moss resembles a snow-bridge over a crevasse, sometimes with a really deep drop beneath. In more than one place there was a drop hundreds of feet deep. In fact, the only tricky bit on that actual expedition was when climbing up the perpendicular wall just before reaching the summit; a wall not of rock, but of moss and tree-roots. However, there is no real difficulty in climbing these tropical mountains so long as there is vegetation, because it is only a question of hanging on. We eventually reached the top, and I spent a somewhat cold night there. On the following morning we had to hurry off because we had come to the end of our food. Before descending I saw another peak on the same ridge which the natives all said was lower, though I maintained it was higher. In the end we went to it, and it was higher, in fact, just under 8000 feet, and on the topmost point we deposited a bottle containing an account of the first ascent.

A striking example of the way in which Banks and Harrisson organized the expedition was that we all arrived at the Government station within two days of one another.

Dr. T. G. LONGSTAFF: As a member of the Oxford University Exploration Club I wish to acknowledge our indebtedness to Mr. Banks, himself an Oxford

man, for consenting to lead the expedition of which we have just had such an interesting account from Mr. Harrisson. We appreciate Mr. Banks's successful efforts in preserving the health of the party under trying conditions, and, even more, the masterly way in which he steered them into friendly intercourse with the natives: a result only attainable by one who has personal knowledge of and sympathy with their special characteristics. Conditions of transport are difficult in the interior of Sarawak, and we have heard how successfully Mr. Banks overcame them. No less valuable to the party was his intimate knowledge of the natural history of the country. Equally the Exploration Club is very grateful to Mr. Harrisson, of our sister University, for all the trouble he took in organizing the expedition in England and for the great amount of time he devoted to its preparation.

As a mountaineer I would congratulate Mr. Banks and Mr. Moore on the first ascent of Kalulong, supposed to be inaccessible. Then Mr. Shackleton's resolution, naturally to be expected in the son of his father, took him to the top of Mulu, the highest peak in Sarawak; a new and difficult ascent.

The scientific appendices which will be printed in the *Geographical Journal* contain only brief summaries of the very large amount of work accomplished. I look forward to very much fuller reports on the biological work in other publications. Meanwhile I would congratulate Mr. Harrisson on the excellent presentation of the results of the expedition which he has given us in his paper to-night. I doubt if a better paper has appeared in our *Journal* on any comparable piece of work.

Our greatest debt of gratitude is of course due to H.H. Sir Charles Vyner Brooke, and to representatives of his Government in London and Sarawak, without whose whole-hearted collaboration and generous assistance in many directions the venture could never have succeeded. Long may Sarawak continue to enjoy its present benign form of government.

The PRESIDENT: I am not a member of the Oxford University Exploration Club, more's the pity, but I very much envy those who are. Speaking from an outside point of view—outside the club, that is—I have no doubt that they have, judging by the work which has been described this evening, justified their existence. If Dr. Longstaff will permit me, I would add my congratulations to those that he has already offered to the whole expedition.

Sarawak is an extraordinarily interesting country, and one which has been visited much more often than many think. It is my practice, and I have no doubt it is the practice of many of you, before a lecture or otherwise, to look up in the Library what others have done, and it is interesting to read that Marco Polo found there was much trade going on between China and the whole of Borneo. Then there was a gap of a couple of hundred years, and we find that the Portuguese, when they took Malacca, sent a man up to Borneo, and that Magellan's ship paid a visit there after his death. The first Englishman to go to the island was a man named Cowley in about the year 1865, and he was followed some few years later by an Italian botanist.

Then to come down to the last century, if you read a book by Sir Spencer St.John, entitled 'Forests of the Far East,' you will find a most interesting account of the whole place, and an ascent—I think it was the first—of a mountain called Kinibalu, all charmingly described.

To turn to the expedition of which we have heard an account to-night, I should like, first, to say how pleasant it was to older Fellows of the Society to hear the name of Mr. Hose. We have still the most affectionate remembrance of that great figure who helped us so much and was on the Council for so many years, and of the excellent work he did in various ways in Borneo. The expedition about

which we have heard to-night was admirable: well conceived, well organized, well executed; and you have given us, Mr. Harrisson, a most interesting description. Like Dr. Longstaff, I have had the advantage of reading the paper. We expect a great deal of you during the next forty years, Mr. Harrisson. We know you are shortly going on an expedition on which, in all seriousness, we wish you every fortune. We know that you are going to be away a long time, and after the vivid description you have given us this evening we shall hope to hear an equally vivid description of your travels in the New Hebrides and the islands in that vicinity.

I hope you will give me Mr. Banks's address in order that I may write to him to-morrow and tell him what an exceedingly interesting evening we have spent. May I also wish well to the other members of the expedition who are, no doubt, going at some time on other expeditions. We have heard Mr. Hartley say he hopes to go again to Sarawak, and he has shown this evening, in recounting what he did on the last occasion, that he will be able to give an admirable description of his next visit. We know that Mr. Shackleton is going to Labrador and later perhaps farther than that, and he knows quite well that he will carry with him the sympathy and the support of this Society. I beg you therefore, Mr. Harrisson, and all your expedition, to accept the very sincere thanks of the Society both for your work and for the most interesting evening that you have given us in the description of it.

THE JAPANESE SOUTH POLAR EXPEDITION OF 1911–1912: A Little-known Episode in Antarctic Exploration

IVAR HAMRE

TO most people who are interested in things Antarctic the name of Shirase will probably be familiar, but beyond a vague idea of his South Polar Expedition little is known of this fine undertaking outside Japan, and even there not very much. A short résumé of an account written in Japanese will therefore be of interest as a contribution to Antarctic history.

The present article is a free adaptation of an abbreviated account of the expedition contained in Vol. II (*Nan-Kyoku-tanken, i.e.* South Polar Exploration; by M. Harada and O. Matsuyama) of a twelve-volume compilation entitled *Sekai Tanken Zenshu*=literally "World Exploration Complete Collection." The part dealing with the Japanese Expedition of 1911–1912 is headed simply *Shirase Chui* (Lieutenant Shirase) and is based on a special fully illustrated account of the expedition entitled *Nan-Kyoku-ki* (South-Pole-report), edited by *Nan-Kyoku-tanken Koen-Kai* (Association of Supporters of South Polar Exploration). The accompanying illustrations are reproduced from the latter work. The writer feels bound to apologize for the transitions, at times somewhat abrupt, from narrative to diary and *vice versa*, which he has been unable to avoid.

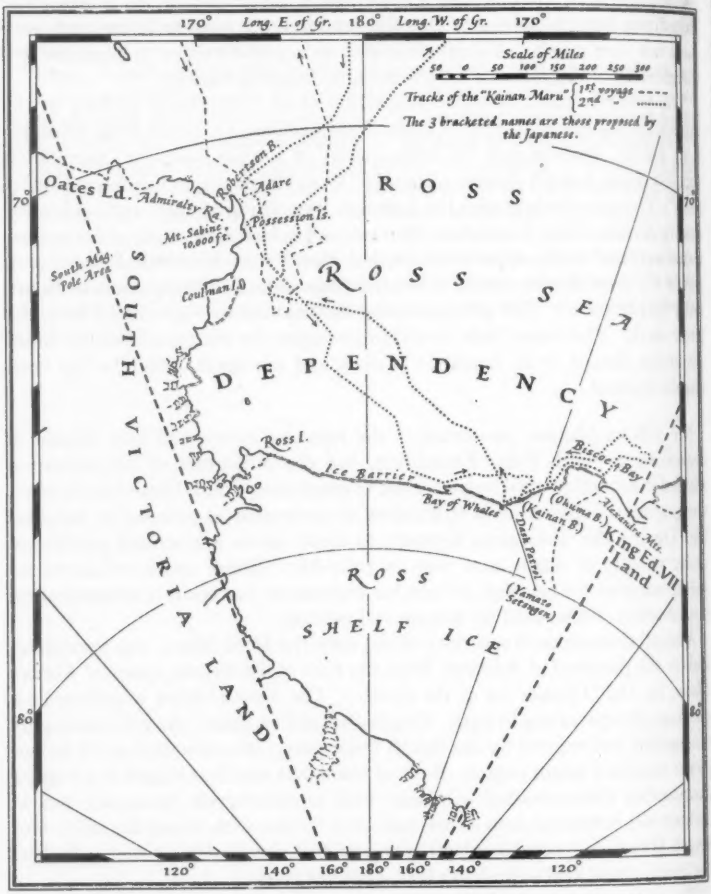
Mr. Choku Shirase, lieutenant in the Japanese Army, had long dreamt of organizing a South Polar Expedition, but the difficulties of its realization seemed insuperable until he succeeded in interesting Count Okuma in his plan. Geographical exploration is still rather an unfamiliar experience in Japanese life. During the Tokugawa Dynasty to leave Japan was strictly prohibited under penalty of death, and even in 1910 Mr. Shirase could reckon on no public support for his plan, so that his expedition was entirely dependent on contributions subscribed by private individuals.

A small three-masted schooner of 204 tons, the *Hoko Maru*, was purchased, and on the proposal of Admiral Togo, the hero of Tsushima, renamed *Kainan Maru, i.e.* the "Opener-up of the South." The *Kainan Maru* was altered for purposes of exploration in 1910. Originally a sailing vessel, she was thoroughly overhauled and refitted by the South Polar party, who installed an 18 horse-power auxiliary steam engine. Built of wood, she was first rigged as a regular barquentine (three-masted schooner with square-rigged foremast), but at Sydney was converted into a fore-and-aft schooner with triangular sails. Her length (between perpendiculars) was 100 feet, her beam 25 feet 9 inches, her depth (from keel to deck) 13 feet, draft not given.

The ship was strongly built for ice-navigation, the keel being of zelkowa covered on both sides with pine; the frame and side planks of zelkowa and cypress, the stanchions of pine. The sides were constructed of two layers of $3\frac{1}{2}$ to 4 inches thickness, covered by a layer of felt and iron plating. The bows and stern were protected along the water-line by an additional layer of wooden planks for one-quarter of the ship's length; the stem-piece was covered by an iron sheath.

Under a display of bunting, with the national ensign, the Sun-flag, and the

special flag of the expedition, with the Southern Cross for emblem a-top, the ship left Tokyo on 29 November 1910, and, after having called at Tateyama Bay for trimming her cargo, left Japan on 1 December 1910 full sail southwards. From the very start the explorers were much hampered by constant bad weather. They crossed the Equator on December 29 and reached Welling-



Route of the Japanese South Polar Expedition in the Ross Sea

ton, New Zealand, on 7 February 1911, where they met with a cordial reception on all sides, private and public. Here they procured fresh supplies and shipped 32 tons of coal and 36 tons of drinking water.

They left Wellington on February 11, meeting the same bad weather as before, a very rough sea and heavy gales unremittingly pursuing. For the first three days the waves were of a height never seen before by the ship's captain,

Nomura, a sailor of many years' seafaring experience. The little *Kainan Maru* was like a toy played with by the furious elements. On the 15th the sea was calming down considerably when a dense fog set in lasting for a couple of days. A curious feature recorded at this time was a general attack of headache which could not be accounted for. One day a queer animal was observed swimming towards the ship's side; it was scooped on board and identified by one of the naturalists as a penguin.

February 24, 1911. Weather showing signs of improving.

February 26. First iceberg appeared.

February 27–28. Navigation difficult on account of icebergs and drift-ice. Canvas reduced by half and fires lit under boilers. Ice of all sorts was met with, brash-ice and icebergs of every size from giant bergs down to ice-blocks. A faint shimmer of aurora observed.

March 1. Brilliant aurora. Iceberg encountered some 300 feet high with a circumference of about 3 miles.

After many vicissitudes in very variable weather, with dense fog, rough sea, heavy snowfall, and other polar conditions, land was finally sighted on March 6 in a south-south-east direction about 40 miles away off the Admiralty Range of Victoria Land. The sea was studded with numberless drifting bergs, of which one running on the same course as the ship was about 250 feet high. On top of these bergs hard wind-beaten snow made a beautiful sight.

March 8. Off Dorset Point, about 6 miles away. Landing was impossible, so the ship proceeded past Possession Islands.

March 9. Drifting pancake ice met for the first time. Small ice-plates strikingly like lotus leaves which gradually grew thicker, up to 12 feet, assuming the shape of tumblers. To starboard Coulman Island now came in sight. The compass needle here was wildly disturbed. An observation of latitude gave 73° 26′ S. Penguins in numberless flocks, also marine animals.

March 11–12. Continuous snowfall with, at times, strong gales. Weather exceedingly unsettled. Changes would take place in the twinkling of an eye. At midday the ship came into heavy ice. Position 74° 16′ S. and 172° 7′ E. Here progress came to a stop. The situation had become critical, and there was nothing for it but to beat a retreat, the danger of being frozen up being imminent. Every moment was valuable, but thanks to the fine seamanship of Captain Nomura and his crew they succeeded at the very last moment available in dodging round and getting out again: a very narrow escape on which the Japanese author dwells at length. If they had been ice-bound at that juncture it would probably have meant death to all, seeing that the expedition was not fitted out for a wintering. The ship suffered some material damage through this unforeseen struggle with the ice.

The ship's company were indescribably dejected at this failure of their undertaking, but for the time they had to be satisfied with what they had achieved. They had cruised along part of the coast of Antarctica, and from the crow's nest the chief officer had as far as possible observed the interior of the land of which he gave a description.

Heavily downcast they had to wend their way northward again, and after a very rough passage the *Kainan Maru* entered Sydney Harbour, New South Wales, on 1 May 1911.

At this time the general feeling of the Australians was strongly anti-Japanese. The reception with which the Shirase Expedition was met was not agreeable, the more so as the press was hostile. Happily these misgivings were soon scattered; indeed, the authorities finally went so far as to grant the expedition the favour of considering their vessel as a foreign government ship, giving her good berthing accommodations and exemption from harbour dues.

In a suburb of the town in a fine grove of trees a site was gratuitously assigned to the Japanese visitors by the owner, and here they erected their own hut. This site commanded a most glorious view of Sydney Harbour. The hut, which was intended for Barrier life, had been the object of much deliberation and experiment, and was solid and commodious enough for its original purpose, but it seems inconceivable that it could accommodate as many people as the whole crew. Still, when finished it seemed to them quite a palace, especially at night when they were lying on their mats on the floor—so infinitely more agreeable than the shelf-like bunks on which for such a long time they had made shift to sleep in the *Kainan Maru*. On 17 May 1911 Captain Nomura with one of the staff left for Japan to report on the present state of affairs.

The camp life on land soon became intolerably monotonous, the frugal repasts being their only diversion. Their staple food was rice, beside which they had quite a varied store of conserves and a small quantity of vegetables. But, however lonely and tedious this kind of life might seem, never a word of discontent was heard. The determination of the expedition was unabated, although in Japan there were many who doubted the advisability of a renewed attempt to push southward.

On October 18 Captain Nomura came back from home with a fresh stock of provisions and supplies; later on some new members of the staff, and twenty-nine dogs from Karafuto (Sakhalin), arrived, and some of the crew had to be sent home on account of sickness.

The original plan of the expedition comprised a dash towards the Pole itself. This plan was now modified, both Scott and Amundsen having probably in the meanwhile started on their race for this goal. The principal aim of the Japanese expedition was now concentrated on scientific exploration. From quarters at home interested in the undertaking, a landing at lat. $77\frac{1}{2}°$ S. and about 160° W. was suggested as the proper first step. From this point exploration might be carried on in a south-easterly direction. Further, a coasting party was to be organized for exploration in Edward VII Land, while the *Kainan Maru* went on a surveying cruise as far eastwards as possible. As will be seen, this programme was thoroughly carried out.

The personnel and scientific staff of this second part of the expedition were as follows: Shirase, leader of the expedition; Takeda, leader of the scientific staff; Ikeda, naturalist; Mii, physician; Yoshino, in charge of clothing, equipment, etc.; Nishikawa, steward; Nuramatso, secretary; Tada, assistant naturalist; Watanabe, cook; Taizumi, cinematographer; Yamabe and Hanamori, in charge of dogs.

Mr. Takeda, chief of the scientific staff, made use of his opportunities for conferring with Professor (now Sir) T. Edgeworth David, Professor of Geology at Sydney University and a member of Shackleton's Expedition of 1907–9, who took a great interest in the Japanese undertaking.

After a stay of more than six months in Sydney the *Kainan Maru* sailed on 19 November 1911 provisioned for over two years. At Shark Island the last visitors who had come to wish success to the expedition went ashore, among them Professor David.

At first the *Kainan Maru* had a good run with a fine spell of weather. On December 3 she was off the Auckland Islands, and here the ship was accompanied by innumerable flocks of sea-birds of all descriptions. On December 9 the temperature dropped to zero.

December 10. First snowfall.

December 11. First iceberg observed, shaped like a Latin M, the ice being of a rotten consistence. Met further on with a long row of big icebergs, like a line of battleships in column, a most impressive sight. This squadron of rotten ice had scattered the sea with an enormous mass of blocks of all imaginable shapes, making navigation very difficult, especially as the ship was still under sail only. The continuous jolting against the ice booming like the firing of cannon was very trying to the nerves.

December 12. The snowy petrel made its first appearance. On top of the white icebergs black specks were seen in great number: they were penguins.

December 13. Sea all round, an endless white plain. In the night the ice grew considerably thicker and gradually became more cumbersome, but a gale sprang up, sweeping the ice away. Quite a sensation was created by a sudden lighting up of the ship's starboard side accompanied by a fall in temperature to 7° F. equally sudden. All who were below came rushing on deck to learn the reason: an iceberg about 350 feet high some 6 miles off.

December 16. At 9.40 a.m. a gunshot was heard. One of the Ainus had lodged a bullet in a seal, but not mortally. A young sailor, Shibada, who had been with Gunji, a noted adventurer, in Kamchatkah waters, stripped off his clothes and jumped into the icy sea in order to dispatch the seal at close quarters, with the result however that he soon had to be rescued, his limbs becoming totally numb. For this feat of hardy manliness the young man was rewarded by the leader with a tin of fruit.

December 21. The Antarctic Circle was crossed in the morning east of meridian 177° E., the course being south-east. A very long white iceberg showing on the horizon was heralded by a sudden drop of temperature followed by a furious blizzard.

December 22. At midday meridian 180° was passed and the ship entered west longitude, but only for a day. The end of the great berg was still out of sight.

December 23. The course was shifted to south-west and the navigation through pack-ice became so very difficult and tiresome that the nerves of the captain and his crew were put to a very severe test. Penguins and seals were met in numberless flocks. The ship was now drifting into the current, crowded with pack-ice, running along the coast of Victoria Land. A furious blizzard arose from the south, making a heavy foaming sea. Most uncanny.

January 1, 1912. In Japan and China more attention is paid to the New Year than in any Western country. All men were about from the break of day dressed in their best. Everything on board tidied up and trimmed as best they could. A procession of all hands through the leader's cabin paid respectful

homage and obeisance to Their Majesties in effigy, besides observing the usual ceremonies of the season. The festival dinner was very sumptuous, with a number of dishes principally consisting of fish. Thus sea-bream was served in eight different ways. Every one was in high spirits and the ship resounded with hearty laughter. On both January 1 and 2 a strong wind was blowing.

January 3. The weather improved greatly and the gluttonous birds were again on the wing, and the cry of "Land, Land" was heard. For the first time the leader and the captain were seen smiling. Through a rift in the cirro-stratus clouds they could barely see the vague outline of a mountain range, with very high pinnacles in the centre. They were off South Victoria Land, and the range seen was the Admiralty Mountains with their soaring peaks, those of Adam, Minto, and Robinson, and others of more than 10,000 feet and of great grandeur and beauty.

As they passed along the coast the land unfolded. The ice-plains at the south end of Robertson Bay came in sight. Cape Adare was passed in the morning. The white shape of Whewell appeared ahead, as Mount Sabine receded behind. To the west in the beams of the sinking sun the silhouettes of Possession Islands stood out in relief, looking rather like hats. The waves of the Ross Sea are quite different from those of the Pacific Ocean: they seem as if they were oiled. At 0.55 a.m. the altitude of the sun was 3° 30′ above the south horizon. The light-intensity of the sunbeams differs in the morning and in the evening.

January 4. Coulman Island showed to starboard.

January 5. A big seal was shot. It was turned to good account, all of it to the very bones, giving food to the dogs, fuel, etc., and the naturalists examined its entrails, finding that the animal lived on cuttle and other fish. About a hundred parasites of some 2 inches length were found, and also a considerable number of "white bullets," *i.e.* undigested fishes' eyes. Two penguins were caught alive. By way of reward an extra treat, consisting of a glass of brandy, was served to each man. The penguins were killed and stuffed. In their crops three stones were found: means for furthering digestion.

January 10. At 2 p.m. the look-out in the crow's nest called out: "An ice-wall in sight!" From deck nothing could be seen of it. The height of this wall was about 200 feet, stretching uninterrupted like a curtain along the horizon to starboard.

January 11. The ice-wall was approached within about 3 miles. In the evening a beautiful atmospheric phenomenon was observed: the sun with four mock-suns around it, beautifully coloured.

January 12. Fast approaching the Bay of Whales, but navigation was very difficult because of floating ice compelling an endless zigzag course.

At 3.30 p.m. the ship was attacked by a school of twenty killer whales, apparently believing that the unfamiliar object was a whale. As soon as they became aware of their mistake they quickly withdrew slouch-eared. This ridiculous event led to another not less so. These killers, the most cruel and cunning beasts of prey of all, are considered by the Ainus as angels of God, and consequently the two Ainus on board the *Kainan Maru* were lost in fervent prayers to and devout worship of these devilish animals during their attack.

January 13. Twenty-two seals killed.

January 15. Ship ice-bound till the following day. Proceeding eastwards the ship went so near the Barrier that the distance was sometimes reduced to one mile only.

January 16. At 7.23 a.m. a sharp point of the Barrier edge was rounded and the ship entered a small bay well suited for a landing. A party of four men with Mr. Takeda as leader went ashore directly and climbed up a steep hill which proved to be the end of a big glacier about 24 or 25 miles in length. The surface on top looked like an even plain, but was nevertheless most dangerous. One of the men fell into a crevasse but was fortunately saved. No march southward from this side could be thought of. This glacier was named "The Four Men's Glacier," and the bay was named "Kainan Bay." Position lat. 78° 17′ S., and long. 161° 50′ W.

The ship now left Kainan Bay, steaming westwards. Most unexpectedly a ship hove in sight some 20 miles away right ahead. "A pirate," it was suggested. It soon however turned out to be the *Fram* of Captain Amundsen. The *Kainan Maru* now shaped her course for the Bay of Whales. She could not get far in though, the ice-belt being still very broad, and had to stop at the eastern edge of the floe-ice at the mouth of the Bay. The *Fram* anchored about 1½ miles to the west. The distance to the Barrier at the end of the Bay was estimated at some 15 miles. The surface of the Bay was one single floe ending in a low wall running west–east at the mouth of the Bay. This extensive plain was dotted with seals and penguins, while snowy petrels circled overhead.

The landing of the "Dash Patrol" was rather a hard job. The outfit of each man was as follows: three shirts, a pair of drawers, a suit, a warm cap, mits, goggles, boots with a felt lining, and a long stick. They were supplied with sleeping-bags of dog fur, the hairy side inwards, covered on the outside with cloth. A landing of reconnaissance was first undertaken, of which the following description is given: The march across the sea-ice belt took about an hour; the men perspired so much as to dim their goggles. The aspect of the Barrier, some 200 feet high, was most uncanny, the more so as blue-brownish vapours were flickering like flames overhead. Here were tracks of avalanches, and ice-blocks fallen down or threatening to fall. The sea was in a constant lazy movement occasioned by these blocks as they "calved" off the ice-wall; here and there a seal showed its face. The ascent of the Barrier was undertaken in three parties. It was difficult, but the view from the top was impressive; seawards the Bay with two vessels, a picture in black and white, and landwards endless ice plains. This excursion being made for reconnoitring only the party now returned to the ship to make all things ready for the "dash" southwards. They had got so sunburnt as to look like negroes.

The details of the preparations for the coming inland expedition need not be dwelt upon here in any great detail. It should be noted that their mits and stockings were of cotton, not wool. The total weight of their provisions, clothing, utensils, etc., was in the neighbourhood of 750 kilogrammes. The carrying capacity of the dogs was rather more than 26 kilogrammes each. Both hand sledges and dog sledges were used. The former were 4 inches high, 1 foot 5 inches broad, and 4 feet long. The dog sledges were 7 inches high, 1 foot 8 inches broad, and had iron runners. The teams were driven in line, one behind another alternating on either side of the rope. Some of the party

suffered from snow-blindness, so that special attention was given to goggles. To avoid dimming of the glass by perspiration a sort of cloth covering was applied. Furthermore, glass of various colours to be changed every three or four days was used, as the constant use of a single colour was considered to harm the eyes. Cavalry boots of an experimental kind ("velvet") proved to be insufficiently warm, and strawboots were then used for ice walking. Even through these however dampness and cold permeated too freely, but they were very useful in ascending and descending ice-slopes. The Advance Party used high sealskin boots of Ainu make, which being completely waterproof were superior to any other sort of footwear.

One day the landing party had a most disagreeable surprise in seeing part of their stores landed on the ice suddenly go adrift, and the recovery of them was very dramatic and exciting. Intercourse with the Norwegians took place when Captain Nomura with the young apprentice as interpreter went on board the *Fram*, a ship which impressed him greatly as an ideal vessel for a polar expedition, and afterwards in his conversation he frequently reverted to the *Fram* and her enviable perfection in every imaginable respect. On the other hand, two of the officers of the *Fram* visiting the *Kainan Maru* were agreed that sailing to the Bay of Whales in such a craft seemed sheer madness, and that they would not venture to go in her half the distance. They were however strongly impressed by Captain Nomura.

January 19. Ice having drifted out, the *Kainan Maru* got up to near the foot of the Barrier and the landing of the shore party was proceeded with.[1] It consisted of seven men, of whom two were to stay on the Barrier edge as a base, carrying on meteorological observations, whereas the rest, five men with Lieutenant Shirase at their head, were to form the proper "Dash Patrol," the Advance Party.

While the *Kainan Maru* was gradually disappearing over the horizon the seven men had finally worked their toilsome way up the steep slope of the Barrier, where, at a point some 2 miles distant from the coast, they set about raising a tent to serve for their base of operations. Its position is given as lat. 78° 33′ S. and long. 164° 22′ W. The tent was pitched on the bottom of a depression of about 4 feet which they dug out. A snow wall was built for further shelter. At a temperature of −13° C. a charcoal fire was kindled in a brazier. Owing to a mistake the party lost count of the time, and their first "breakfast" of sea-bream, *miso* (*i.e.* bean paste), and *miso* soup was taken at midnight. The mistake rectified they went to "bed" again.

January 20. Leaving Muramatsu and Yoshino behind at the tent, the "Dash Patrol" proper, consisting of the leader Shirase, with Takeda, Mii, and the two Ainus Hanamori and Yamabe (dog experts), left their base at midday, the dogs hauling the sledge. Marching was very toilsome, the more so as they were attacked by a furious blizzard, forcing them to camp. The distance covered was less than 8 miles. Tents should be coloured green, as were those of Shackleton, but green canvas is not durable when the tent is heated for cooking.

[1] The *Kainan Maru* here reached her southernmost point, viz. 78° 34′ 30″ S. The *Fram* reached 6′ 30″ farther south, 78° 41′, a record which she held up to 1925, when it was beaten by the Norwegian whaler *Star III* (Captain Iversen) which reached 78° 46′. All these high latitudes were reached in the Bay of Whales.—I. H.

開南丸の雄姿

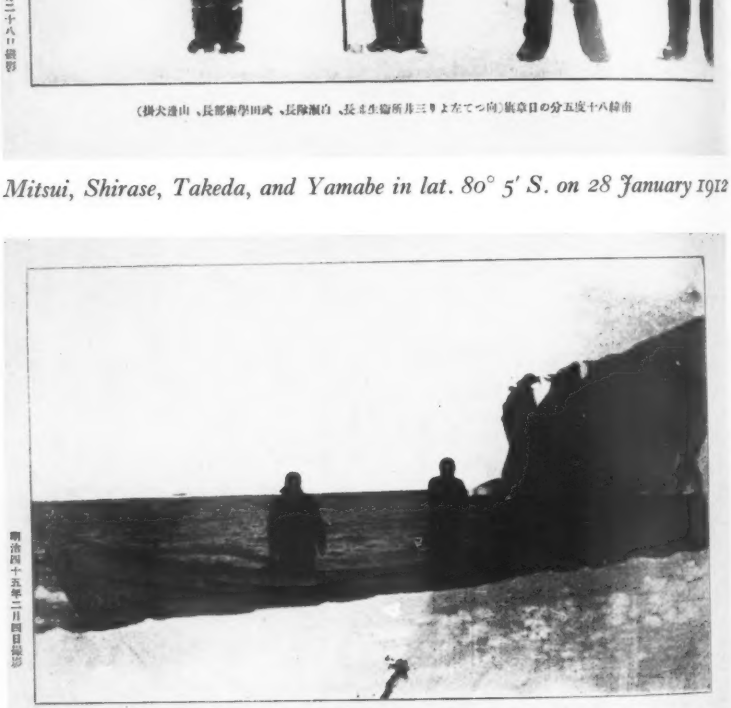
The "Kainan Maru"

All the members of the Second Expedition photographed on New Year's Day 1912; Captain Nomura central figure standing, Lieut. Shirase to his left beside the bearded Ainu: both bare-headed

明治四十五年一月二十八日撮影

（撮者山邊、長部衛學田武、長隊瀧白、長ま生物所井三りよ左てつ向）南緯八十度十分五度十八日第

Mitsui, Shirase, Takeda, and Yamabe in lat. 80° 5′ S. on 28 January 1912



明治四十五年二月四日撮影

（丸商間はるゆ見に方南土轉運等二井酒ほ人一の他長夫水川高はるせに手を指：景光揚引測船

The boatswain and second mate of the "Kainan Maru" in the Bay of Whales, 2 February 1912

January 21. No progress made owing to bad weather.

January 22. The dogs lagged somewhat on account of the overweight they had to haul. Men therefore pushed behind, but it did not help much; the dogs were soon again exhausted, and there was nothing for it but to lighten the sledges, and part of the gear was cached in the snow, a red flag being planted above for a mark. The compass proved wild, because of some objects of iron too near it. At 9 p.m. something like a mountain was seen to the south-west. Takeda and the two Ainus set off to examine this mountain, which turned out to be an ice-wall of some 200 feet above sea-level. About 15½ miles were covered this day.

January 23. Making headway, moving on the up-grade. Dogs very fit, making an excellent haul. In the course of the march the men took off one shirt after another, but after a moment's halt the cold immediately froze them to the quick. The dogs were now much done. A blizzard had sprung up; but the distance covered this day was about 22 miles.

January 24. The somewhat prolonged stay in the tent during the blizzard was extremely disagreeable owing to the humidity. The fur clothes made on the military model proved very good and answered the purpose well. The surface now proved most difficult, the strong wind having beaten the snow hard; small hummocks of ice had formed, constantly threatening to capsize the sledges. The frame of the compass was broken, and it took the men a good while to repair it with their stiffened hands at a temperature of −18° C. At 7 p.m. the temperature had fallen to −22° C. One of the dogs got frostbite in one foot, and, two other dogs being already sick, only twenty-seven dogs were now available for hauling. Distance covered 23½ miles.

January 25. A heavy blizzard again raged. Communication between the two sledges was broken off, a most critical situation for one of them, seeing that all provisions were loaded on one sledge only. Temperature −25° C. After much seeking and halloing without result one of the Ainus discovered traces of blood from the frostbitten dogs and other marks of dogs, and communication was re-established. The weather grew more and more dirty, and it was resolved to camp. It was impossible to get the dogs inside a tent. They *would* lie in the open, letting themselves be snowed up. The blizzard was so heavy that it was simply impossible to go outside the tent. The drizzling snow crept in everywhere, forming small sastrugi on the sleeping-bags. Temperature −22° C. Distance covered 21 miles.

January 26. Blizzard increasing. The dripping from the tent walls when preparing meals was very disagreeable. Taking stock of the provisions, the party found that they would last for only two days more outward march, when they would have to turn back. Another dog frostbitten. Distance 13½ miles.

January 27. At 2 a.m. first rest, starting again at 5.30 a.m. To the east four peaks were sighted. For about two hours the men now marched in this direction, when they again shifted their course, having satisfied themselves that the appearance was only a mirage. Distance covered during last night and to-day's fore- and afternoon totalled rather less than 30 miles. At 6.30 p.m. the party set off again due south. Dogs now exceedingly tired, men had to stagger along on foot, worried by the nasty hummocky surface. Temperature −12° C. Puffing and panting they plodded along until the next day.

January 28. At midday the "Dash Patrol" had come to the end of their tether and had to turn. The last two stretches were about 27 miles and 2½ miles. Thus the total distance covered on the outward journey amounted to something in the neighbourhood of 160 miles. The position of this extreme point of the advance, according to observations taken by Takeda, was lat. 80° 5′ S. and long. 156° 37′ W. At this point they made a cache in which they deposited a copper case holding a list of the names of the persons who had been instrumental in the realization of this Japanese South Polar Expedition. And they raised a bamboo pole from the top of which the national Sun-flag was flown revolved by a red-painted triangular weather-vane of tin. They paraded before the Sun-flag and raised a threefold *Banzai* for His Majesty the Emperor, and the region around within eyesight was named "Yamato Setsugen," *i.e.* Yamato Snowplain, *Yamato* being the poetical name for Japan.

January 29. At 2.30 p.m. the party started on the return journey which, compared with the outward march, proved relatively easy, and they reached their base just as a fog was forming on January 31, after an absence of twelve days spent in hard marching. The *hoosh* served by their two comrades was more than freely accepted and partaken of, whereupon they turned into their bags and slept for thirty-six hours on end.

During the absence of the advance party the two men at the base had carried on various kinds of meteorological observations. The temperature had been down to —23° C. One day, some 3 miles south-west of their base, they observed ski tracks, and, walking 7 miles farther, they came to a tent, which proved to be a look-out point of the Amundsen Expedition. But the tent was empty and nobody appeared to satisfy their curiosity. In about half an hour the *Fram* hove just in sight, entering the Bay, and at the same time some men came along the shore on ski, which in the Japan of that time were practically unknown. The two Japanese were much impressed by this mode of locomotion, which they had never seen before, reflecting on the possibilities lost to their own expedition by their absence.

February 3. The *Kainan Maru* was sighted in the morning, but not till next day was she able to get up to the Barrier and take the Advance Party on board.

After having landed the Advance Party (the "Dash Patrol") in the Bay of Whales, the *Kainan Maru* left this Bay on 19 January 1912 at 5.30 p.m. bound for Edward VII Land, which was sighted on January 23 at 7 a.m. It was a grand view they had before them, a range of white defiant pinnacles soaring towards heaven. At 4 p.m. they anchored in Biscoe Bay in lat. 76° 56′ S. and long. 155° 55′ W. Before them lay the Alexandra Mountain Range in all its majesty. The upper part of this range is divided into three separate mountains, of which the central one is the highest.

Two shore parties were formed, one of four men with Tsuchiya, the chief officer, at the head, and one of three men. Having crossed the ice-foot they had to scale an ice-wall, at first going due south, after which they turned westwards. The Tsuchiya party turned due south again to climb a steep ice-wall 200 feet high, but were defeated.

The other party went south-westwards. After having gone a couple of miles they came across traces of birds, which they followed, meeting at length

a flock of Emperor Penguins showing no signs of fear. One of the men presumed to "shake hands" with one of these beings so human in their behaviour. But his patting seems to have been taken up in a way quite their own, for the result was a round of beak-strokes from one individual to another until it came back to the starting-point and the circuit was closed.

A bit farther on they came to an ice barrier 200 feet high. After an hour's hard toil they had reached the top. Before them an endless ice plain stretched in all directions as far as the eye could see. This plain had a striking likeness to the shell of a tortoise with its maze of cracks and fissures. The breadth of these cracks varied from 1 to 3 or 4 feet, and the distance between them might amount to 6 metres. Out of these cracks a greenish uncanny light was emitted.

They now went down the wall again, one of the men, Taizumi, the photographer, returning to the ship, while the two others, Nishikawa and Watanabe, sought for new openings. To the left, roped together, they scaled another ice-wall 150 feet high with a gradient of about 70°. They came across some heaps of ice pebbles, round-shaped and of 5 inches diameter, which resembled fish-scales and, when trodden, gave a peculiar sound like "karang-karang." After two hours the top was finally reached.

Before them the climbers now had the Alexandra Range. The sun shone agreeably. In a sweat the two men pushed on, but at midnight of January 23 a blizzard suddenly fell on them and they had to dig themselves into the snow, indulging in some milk heated over a lamp made of some old cotton soaked in spirits. After an hour or so the blizzard had blown itself out and they could proceed. On January 24, at 6 a.m., they were 10 miles from their starting-point and had barely reached the foot of the mountain which rose above them in a steep precipice. Fourteen hours had elapsed since starting. Here they took a rest, which however was disturbed by an avalanche, from which they had a narrow escape. They now made for the black rock serving as a landmark standing high overhead, and they plodded on upwards. After a while however their progress was stopped by a crevasse 3½ metres broad which they could not cross. They could see no end of this crevasse, from which a green light was emitted. It was hard to stand the disappointment, but there was nothing for it but to turn back.

On this spot they erected a memorial board bearing the following legend: *Dai Nippon Nan-kyoku tanken-tai engan-tai joriku kinen-hyo*, which in English would read literally as follows: "Dai-Nippon South Polar Expedition Coast Landing Party Monument." Besides which it gave the names of the members of the expedition and the date, 24 January 1912.

They did not go back directly. One of the two, Nishikawa, went on to the right until he reached the ridge of the mountain on a level with the lowest of the three mountains. No human being had ever seen the back of this mountain range before.[1] To the south-south-west the central mountain showed. The distance to the edge of its foot was estimated at 6 miles. There was an unbroken ice plateau without any undulation, looking just like the Lapis-Lazuli World as depicted in the Buddhistic Scriptures. Not a dust-mote was to be seen.

[1] Two months earlier, the Eastern Sledge Party of the Amundsen Expedition (Prestrud, Hj. Johansen, and Stubberud) had been just behind the Alexandra Mountains which, in their view however, "could not be called an imposing range."—I. H.

After having for some time enjoyed this glorious view, Nishikawa turned back. On his way he was so unfortunate as to attempt to cross a snow-bridge over a crevasse and fell through. Happily the breadth of this crevasse was only 2 feet, and his fall was stopped, his coat being caught by some projection. But he could get no purchase either with his hands or feet. Happily however his comrade, who was not far away, heard his shrieks and came in time to rescue him. Having walked another mile they came to the highest point of the ice-plateau. From this point they observed a new mountain range branching off in a south-south-easterly direction some 12 miles long. Height estimated at 1000 feet or thereabouts.

On January 24, at 10.30 p.m., Nishikawa and Watanabe came in sight, dragging along dog-tired after twenty hours' scrambling amongst these Alps. Distance covered about 15 miles. Alarmed at the long absence of this party a second party had in the meanwhile been started off in search of them.

This land of Edward VII was discovered by Scott in 1902; he could not land then because of ice and heavy sea. The Japanese shore party were the first to give a special description of it. These regions are very rich in polar phenomena, and the collection of specimens brought home made quite a polar museum.

According to angular measurements from the anchorage the highest peak of the Alexandra Mountains proved to be 1600 feet above sea-level. The depth of the Bay is about 140 fathoms. The sea bottom is fine ashy loam.

The *Kainan Maru* left her anchorage going eastwards along the coast of the Antarctic Continent. Taking stock of their stores, they found that the bunkers had been reduced from 55 tons to 16 tons and provisions and water had sunk to 15 tons.

In lat. 76° 6′ S. and long. 151° 20′ W. Captain Nomura turned the ship's head round towards the Bay of Whales. Compared to the 152° W. attained by Scott the preceding year it will be seen that he reached a point 40′ more easterly.

This run was much hampered by icebergs and drift-ice. Many of these bergs were studded with black specks and, unconscious of the risks run, Tsuchiya and two sailors lowered a boat to go exploring. They made fast to the berg, ten stones serving for anchor, and ascertained that the black stuff was mud and loam. They had barely finished their investigation and were on the way back to their ship, when a fearful thunder was heard, and a colossal iceberg came rushing up from the bottom, throwing around a shower of ice-blocks of all sizes which, scattering round within a large circle, made as many fountains of fantastic dimensions. This iceberg had probably been attached to the sea-bottom and had got loosened. Those on board the *Kainan Maru* who had witnessed this horrible spectacle were pretty sure that the worst had happened to the boat's crew. Their joy can be imagined at their return safe and sound. It was indeed a close shave.

On her way the ship put into a small bay of the Barrier in lat. 77° 50′ S. and long. 158° 40′ W. This bay was named "Okuma Bay" in honour of Count Okuma, the principal promoter and supporter of the expedition. Okuma Bay was 3 miles in length east to west, and had a breadth north to south of 2 miles. Depth 130 fathoms. The water was of a light brown colour, for which the explorers could not account; perhaps it was due to mud from the sea-bottom accompanying ice floating up.

On January 30 they left for the Bay of Whales. On the way they had a new sensation: an iceberg calving off a big block with thundering reports.

On February 1 the ship was off the Bay of Whales, but the wind being contrary she was unable to get in till next day. The aspect of the Bay had much altered since they left, when it was nearly filled up with drift- and glacier-ice.

On February 3 the captain tried to communicate with the shore party, but had to desist, the sea being too heavy. Two men trying to walk across the ice-foot fell into the water and had to retreat. At 1.30 p.m., the weather having in the meantime improved, the ship could finally approach the Barrier, and after much trouble the men of the shore party were got on board, though the stores were still left ashore. The next day, February 4, dirty weather again set in with a strong southerly wind, fog, and snow, and it was a close shave to get the stores on board.

In view of the dangers threatening from the Barrier they dared not stay longer in "harbour," but had to leave in all haste. Thus they were not in a position to pick up the dogs, a score of which were marooned in the uninhabited land.

The *Kainan Maru* now started on her return voyage, and on March 23, at 3.30 a.m., she re-entered the port of Wellington, New Zealand, about five months after her departure. After having taken on board a fresh supply of provisions and coal she left Wellington on April 2, and on June 18 entered the harbour of Hojo, province of Awa. On June 19 the expedition arrived at Yokohama, which it had left on June 20. On the same day, under display of all their bunting, with the Sun-flag and their own Southern Cross ensign a-top, the *Kainan Maru*, the "Opener-up of the South," entered Shinagawa Bay, Tokyo, having run a distance of about 30,000 miles since her departure.

Strange though it may seem, this account of the Shirase Expedition is likely to be the first narrative thereof written in a European language, filling to a certain extent a blank in the history of Antarctica. The reason for the reticence on the part of the Japanese themselves with regard to this expedition is not easy to discover. It is obvious that the expedition of Lieutenant Shirase and his brave companions was a fine undertaking. When the *Kainan Maru* left Tokyo on her way to "open up the South," her sailing was indeed a new departure in more than one sense of the word. As a feat of seamanship, it cannot be denied, it was glorious. We have the words of the officers of the *Fram* that they would not have ventured to cover half the course in such a craft as the *Kainan Maru*. Persecuted by a continuous series of prolonged foul storms, even through the so-called "Pacific" Ocean, this plucky little vessel fought her way farther on through the "Roaring Forties" and the "Foggy Fifties" and the icy and what-not Sixties and Seventies to the very edge of the Antarctic Continent and back again. Such an exploit would seem to warrant that the name of Naokichi Nomura should be remembered among the great navigators.

As an Antarctic venture the Shirase Expedition should be judged, not on the shortage of 10 degrees from its original goal, but in the light of the fact that this was a totally new departure in Japanese exploration based on no previous experience, which in polar regions is perhaps more important than anywhere else; in the light of this fact the Japanese venture of 1911–1912 fully deserves its place, up till now left rather blank, in Antarctic history.

THE ADMINISTRATION OF THE MANDATED TERRITORY OF NEW GUINEA

G. W. L. TOWNSEND

THE Territory of New Guinea, which is administered by Australia as a "C" class Mandate, comprises all of the former German New Guinea Protectorate south of the Equator except the island of Nauru. The total area is approximately 91,000 square miles, 70,000 of which are on the mainland of New Guinea, the remainder being made up of outlying islands. For administrative purposes, the Territory is divided into seven districts, those on the mainland being Sepik, Madang, and Morobe; those of the islands, Manus, Kieta, New Britain, and New Ireland. In only two districts are all the native inhabitants under complete Government control, Manus and New Ireland. New Britain and Kieta have still small areas of unknown country; but the greater portion of the mainland has yet to be explored.

From 1914 until 1921 the Territory was in military occupation by Australian naval and military forces. With the advent of civil administration in May 1921, a policy of exploration and extension of Government influence by means of peaceful penetration was adopted. District Officers were instructed to prepare maps of their districts in areas under the following five degrees of influence: (1) Area under complete Government control; that is, an area into which an unarmed native constable could go for the purpose of arresting a wrongdoer and where he could call upon the natives generally to assist him. (2) Area under partial Government control; that is, an area into which native constables could go in order to arrest a wrongdoer, but where assistance from the other natives could not be relied upon. (3) Area under Government influence; that is, an area where a European officer and his native police would not be resisted if effecting arrests, and where the lives and properties of visiting Europeans and natives would be quite safe. (4) Area penetrated by patrols; that is, an area where Government patrols had penetrated without encountering opposition, but where proper contact with the natives had not been made. (5) Unknown area.

For the most part, the coastal ranges of the mainland lie back but a few miles from the sea, and the inhabitants of the narrow coastal plains had almost all been brought under control by the German administration. The task which confronted the present Service was to get into touch with the mountain peoples; and this proved very difficult, mainly on account of the very wild and rugged country. The mountain population was not large and had therefore all the more country to move about in. As practically every village distrusted its neighbour, houses were always built in almost inaccessible positions, and two sections of a village which could call to one another across a ravine might be 6 to 8 hours distance by road. The language problem complicated matters, for one might say that every 10 miles found a different tongue or dialect being spoken. District Field Staffs were small, usually consisting of a District Officer, an Assistant District Officer, and two Patrol Officers, and it was rarely possible, owing to heavy routine work, to allocate more than one officer for penetration work. The normal length of a district coast-line would be 300 miles, and at

odd intervals along the beach would be coconut plantations, mission stations, trade stores, and other centres of European activities. District headquarters would also, of course, be on the coast.

All natives working as labourers on plantations, or working as personal servants, are employed under an indenture system; and there must be regular inspection by the District Staff of all places of employment to see that the conditions of indenture are being observed by both employer and employee. All villages under complete and under partial control must be visited at least once a year for general administrative purposes. In addition to the field routine, office work is considerable. A district magistrate, either the District Officer or his assistant, must always be available for Court duties. A District Officer is Coroner, Authorised Justice for Marriages, Collector of Customs, and Senior Inspector of Police. Since only one officer at a time may be available to open up new country a system of base camps is devised. An officer, accompanied by ten or twelve native police constables and with sufficient carriers for the transportation of camp equipment and supplies, proceeds to that portion of an area under influence which has been selected by the District Officer. A site for the camp is selected, and there the carriers erect rough leaf-and-timber shelters for the personnel and stores. If the officer were to establish himself in a village the enemies of that village naturally would decline to receive the patrol, and it would be impossible to persuade any strange natives to visit. A site must be chosen therefore which does not indicate friendship for any particular village, but to which all may come.

The patrol is not dependent on villages for food supplies, but it is not long before natives begin trading their field fruits for steel goods, salt, cloth, and other trade articles. As soon as contact has been established in this way with the surrounding villages, the officer begins to patrol the area. Natives, like all other human beings, loathe interference in domestic matters, and quickly see the point when urged to build a rest-house on the village outskirts in which Government officials and other visiting Europeans with their foreign native servants may stay without inconveniencing the villagers. Native huts in mountain country are always built on the ground for the sake of warmth; but it is desirable that the rest-house, like the huts of the base camp, be built, European fashion, some feet off the ground, and the result generally is that the services of a constable are called in to act as an instructor.

When a rest-house has been completed, the patrol visits the village and remains there a few days, distributing small presents to mark the occasion. The patrolling officer is in constant touch with headquarters on the coast by means of police runners, and receives a constant supply of lemon and orange cuttings, and pineapple and banana suckers, and these are planted out at the rest-house. The village is made responsible for the care of the plants, and all fruit eventually borne is put at the disposal of the natives. Visiting Europeans are entitled to purchase fruit, and all such payments are usually made by means of trade twist tobacco.

Although there is no system of hereditary chieftainship every village has one authoritative man who leads in warfare and also in village dancing festivals, and this is the man who receives the Government appointment of *luluai*, or village headman. His authority over the village is confirmed and he is issued

with a cap of rank, blue-peaked with one wide red band around it. He is entrusted with the Village Book in which is entered his name and the date of his appointment. In time it will contain the names of the men, women, and children for census purposes. When possible, a *tultul* is chosen from the village. A *tultul* is appointed to assist the *luluai*, and he is the official interpreter for his village. It is essential therefore that he speak pidgin English, which is, so to speak, the only common language in New Guinea. Should there not be available a native of good character with this qualification, the *luluai* is asked to select a man to go to headquarters to be taught. Four or five months are sufficient, and upon appointment he is given a blue-peaked cap with two narrow red bands around it.

Within a few weeks of the establishment of the base camp the news has gone around the whole country-side that the Government has established a village and is ready to exchange many valuable things for native foods; moreover that it is a peaceful camp and willing to make friends with every one. One day a small party of armed natives appears at the camp, and it is obvious that they are from the unknown area. They have no sooner arrived than they are anxious to depart, so are given a few gifts and told to come back again and bring as many friends as they like. Within a week they will return, perhaps with representatives of other villages. Neighbouring *luluais* are sent for, and should there be any outstanding quarrels they are there and then adjusted. The party is not so anxious to clear out this time, and very probably before the strangers depart the leader is asking his erstwhile enemy where he got his beautiful hat.

Within a few weeks the officer receives an invitation to visit the strange people in their village, and then commences a little by-play. It is doubtful whether the patrol will have time to go and visit, because there are such a lot of presents to be distributed, for one thing. "Why not come and distribute them in my village?" says the old man. "How can I get there," says the officer, "when there are no roads?" With his cupidity aroused, the old man makes light of that difficulty, and it is finally arranged that a visit will be paid when a road has been cut from the camp to the village; and when this has been done, the first step towards the opening up of new country has been made.

On the day appointed, a feather-bedecked party of natives arrives to guide the patrol to the village. They still carry arms, because after all the Government is only a new friend and has for some time been living among their enemies. The police carry loaded rifles, because after all they have only seen these natives in the camp, and the road might easily lead through a ravine or under a cliff. However, the village is reached without incident, and on its outskirts the warriors, some of whom have been keeping parallel to the patrol, hidden in the bush, for the last half-hour, are assembled. The patrol halts, clothing and equipment are fingered and examined, and the white skin of the officer pinched, scraped, and tested with a wet finger to see if the colour is lasting. It is as well if the officer is not ticklish, because chuckings under the chin and poking of navels come next. These signs of friendship given and received, the village is entered, and the women in turn satisfy their curiosity.

Under a large tree are many wooden bowls heaped high with cooked yams, taro, and sweet potato, smoking hot from the earthenware pots, and garnished

with scorched pig—one could not call it roasted—and pathetic-looking smoked flying fox. The police are all smiles, but the officer experiences a dreadful sinking feeling, for he knows that some or all of it must be attempted. After a lot of scrambling and pushing guests and hosts seat themselves on the ground around the bowls. It is noticeable that there is not room for some of the hosts, who stand, with their bows and spears, a little apart; as it happens, one of the constables, feeling sick and unable to eat, leans on his rifle with his back to a broad tree, immediately behind the officer. He is observed to wink at the sergeant opposite him.

The chief guest tries not to see that his host flattered himself upon his powers of ejection when attempting to send a stream of betel-nut juice beyond the food bowl in which he was at that moment raking for a succulent but very foul-looking piece of taro for his guest. Trying to keep his mind off the food and watching with interest the men and women, only a sudden warmth on his bare knee draws the officer's attention to an impossible piece of guts being pressed upon him. However a show of eating it has to be made until the watchful sergeant creates the necessary diversion which enables the dreadful piece to be slipped to one of the prowling dogs. Another portion of the pig is handed to one of the constables, and though what is said cannot be heard, the expression on the face of the recipient together with the roars from the men and the giggles from the women make it obvious that another "smoking-room" joke has been born. Baked sweet potato and fresh sugar-cane need no apology, and these round off the feast. With much licking of fingers and appreciative belching the front row moves back, and there is then room for the standing men. The sick constable declares himself to be well again, and sits down with them.

Persuading the chief host to smoke a cigarette, and then lighting one for himself, allows the officer to refuse, without discourtesy, the much-sucked bamboo pipe. During the period of digestion, a count is made of the houses and the number of the inhabitants is estimated. With the old man to point out and name the villages on the mountains beyond, a rough sketch-map is prepared. Later the whole village would be addressed, perhaps through two or even three interpreters, and the aims and objects of the Government made clear, and the assertion that they would materially gain by "belonging to the Government" is given point to by the distribution of gifts. Care is taken to see that the old women are not forgotten. Care is also taken to see that the new road is traversed before dark.

After perhaps three months, the time comes for the base camp to be broken up and a return made to headquarters on the coast. An invitation is issued to all villages with whom contact has been made to come and feast and dance at Government expense. The one condition laid down is that no weapons shall be brought into the camp, those carrying them on the road must cache them before coming in. *Luluais* and *tultuls* of the villages which will be passed through *en route* to the coast are sent for, because there is more likelihood of the natives of the interior coming out to the coast if they have already met the officials of the villages through which they must pass.

When all the natives have assembled at the camp on the day fixed, each village gives a display of its own particular distinctive dance, and the bird of

paradise feather headdresses worn would turn many a collector green with envy.

After the dancing comes the feast of pigs and native foods purchased from neighbouring villages, and in this the officer is thankful that he need not participate. When the feasting is done, all those natives from the area under influence and probably some from the uncontrolled area who had promised to accompany the patrol to the coast to see for themselves the many wonderful things the white man did and made, are assembled in the centre of the camp and the other natives make a wide circle. Down the centre are aligned the *luluais* of the villages on the route out, each in his proper order; and the stage is set for a pantomime of the trip out. Each *lululai* represents his village and the sergeant pretends to be the District Officer at headquarters. The officer then assembles his party and they go as far as the first *luluai*, who steps out to meet them and gives them a hearty welcome. The officer pretends to inspect the village and is pleased with its cleanliness and order. The party then moves on to the next "village," where the same performance is repeated. When the *luluai* of the village which would mark the normal end of a day's march is reached, he pantomimes sleeping for the night; and thus the watching natives, by counting the number of "sleeps," know how many days the journey to headquarters would take. Upon arrival at "headquarters," the sergeant welcomes the travellers with extravagant gestures of delight, and the next few "days" are spent in eating and sightseeing. At this stage the officer withdraws from the party, and when the time comes for the natives to return to their villages, the sergeant calls a constable and instructs him to escort them home.

Back along the line of *luluais* the party goes, being this time welcomed as old friends; perhaps two "villages" might dispute for the honour of entertaining them for the night. Finally the party reaches "home" and the escorting constable adds his mite to the play. He mimics the return to his village of one of the natives from the unknown area, and takes the squatting circle of onlookers to be his own countrymen gathered to hear of his experiences. His eyes bulge with the recounting of the wonderful things he has seen and his stomach distends when telling of the good things he has eaten. Amidst roars of appreciative laughter he draws forth from an imaginary bag and hands around for wondering inspection the many gifts he has received.

All the guests are sent home before dark, but at intervals; and at least one armed constable accompanies each party until the cached weapons are reached. The natives from the coast who carried in the camp equipment in the first instance have long since returned home, and it is now the duty of the nearest village to provide sufficient carriers to transport the patrol gear to the next. The work is not heavy and each carrier, of course, receives payment. After the return of the patrol to headquarters, small detachments of native police visit the new area at irregular intervals, so that touch should not be lost. It is not long before European recruiters of labour work through, and in the next few years each village has members who have worked for white men, and are strong advocates of the white man's Government.

The Base Camp system was used throughout the mainland of New Guinea with the exception of the river portion of the Sepik District. Until 1924 the

Sepik river was included in Aitape District, but in that year extensive tribal fighting led to the establishment of the new district of Sepik for the immediate purpose of putting a stop to head-hunting. The staff appointed was a District Officer, an Assistant District Officer, a Patrol Officer, and a European Medical Assistant, together with a detachment of thirty native policemen.

For the greater part of its 500 miles the Sepik river has an average width of about a quarter of a mile. There is a dry season and a flood season, each of approximately six months, and the average depth of the river at Ambunti, 245 miles from the mouth, is 45 feet. The river is best described as the main drain of a flooded valley, for even in the dry season there are hundreds of square miles of lakes and lagoons all connected up to the river by natural channels. In flood season the river banks disappear and only the familiar villages and clumps of timber mark the course of the stream. The village coconuts, which would be adversely affected by excessive moisture, are planted on levees above flood-level. Although, in German times, there had been a number of scientific expeditions up the river, including the Dutch–German Boundary Commission, there had been no attempt to bring the natives under control. In 1918 a recruiter was attacked and wounded at Avatip village, about 200 miles from the mouth, and though a military expedition was sent to inquire into the matter, it did not remain long enough to have any lasting effect.

The establishment of district headquarters in 1924 was really in the nature of an expedition, and for this two vessels were used. One, a small steamer of 100 tons, carried stores and personnel, and the other, a 12-ton auxiliary ketch, named the *Aloha*, was for patrol purposes. Steaming during the day and anchoring at night, in four days' time the vessels arrived at the foot of a thickly wooded spur running down from a mountain, the first piece of land encountered which would be above flood-level. The thirty odd villages which had been passed when steaming upstream were built on huge piles.

As soon as rough shelters of sago leaf had been erected for the personnel and stores the steamer returned to the coast, and the expedition began to dig in. As a mission station had been established at the mouth of the river for some years, it was possible to obtain interpreters; but these were only young men who carried no weight in village councils, which were very strictly ruled by the old men. In most villages the interpreters were told to inform the District Officer that his prohibition of head-hunting would be ignored, and woe betide the Government if it attempted to interfere. Within the first month after arrival at Ambunti, a patrol to a village suspected of having just raided another led to a savage attack by a large number of spearmen, who were immediately checked by the police rifles. So early a trial of strength, with the inevitable result, had a very good and lasting effect; but though violence was never again offered to a Government party on the river, the natives would not submit to control for some years. Strangely enough, the village concerned in the attack on the patrol had organized its recent head-hunting expedition in order to initiate two youths who had just returned from indenture with the mission.

Not one river village was willing to be friendly with the police patrols, and passive objection took the form of walking out of the villages when the *Aloha* was sighted. Several old men would be left to report on the movements of the visitors, but these old men would feign ignorance of village affairs and declare

that their presence in the village was due to their inability to get away. This state of affairs continued until it was decided to collect these watchers and take them to Ambunti as guests of the Government. Upon arrival there, they found themselves in a very peculiar position. They ate and slept in the company of men from villages with whom they had been at war from time immemorial; and though as free as air as far as the police were concerned, found themselves unable to return home on account of the hostile country through which they would have to pass. Before long they would approach the District Officer with a proposition. If he would guard them to their villages, they would guarantee to bring the people in for the District Officer to speak to. This would be done, and so most of the men became known to the police, at least by sight. It was not long before the police learnt to pick out the canoe from any particular village by its distinctive markings, and this also assisted in identification when trouble occurred.

Within twelve months the District Officer decided to discontinue patrolling in force, and a system of patrols by armed constables working in pairs was instituted. A fast motor launch had by this time been provided for river work; and natives from the lower river began to visit Ambunti either in the launch or accompanying the patrolling constables. Within eighteen months from the time of the establishment of headquarters at Ambunti, an unarmed native might travel the 245 miles of river with perfect safety, passing through a population of approximately ten thousand people.

As can be imagined, the mosquitoes were a veritable plague, and sleeping baskets are in universal use. The baskets are woven from grasses and are made in the shape of a long sack, being about 15 feet long and 3 feet wide. Half-hoops of cane are stood up at intervals inside, and there is about 2 feet clearance above the sleepers' faces. A man, his wife, and possibly three children sleep in one basket, and as, once retired for the night and the mouth of the basket closed, no one leaves the basket for any reason whatsoever, the atmosphere in the morning beggars description. The police took full advantage of these baskets when raiding villages for head-hunters, usually just before dawn. Each constable would be allotted a house, and, at a signal from the officer, would mount the ladder and, thrusting his drawn bayonet through the flaps of the mouth of the basket and down through the sago-palm skin flooring, would thus imprison the inmates and be free to deal with the other baskets. When the catch had been sorted out, the baskets made very effective temporary detention cells.

Appointments of village officials hung fire for a considerable time. Although from the time of the establishment of Ambunti it would have been possible to have appointed *tultuls* from among those natives who had been working at the mission and elsewhere, it would have been a most unwise step. A *tultul* is not a village headman, and had any appointments been made in the beginning, "taken by crocodiles" would have been the explanations of the disappearances.

A good example of the ingrained hostility of the old men towards Europeans in general was provided at Timbonku village, some two years after the establishment of the Sepik district. The mission body long established at the mouth of the river wished to acquire land near Timbonku village for the purpose of

rice cultivation. Their representative made overtures to the owners and later reported to the District Officer that some were willing to sell and some were undecided. Only Government may purchase native lands, and this is the procedure. When an applicant for land has secured the owners' consent to sell, the District Officer interviews the owners and inspects the land, in order to satisfy himself that no claimants to ownership have been overlooked, and that the land in question is not required for the use of the natives. Should the owners be willing and the District Officer satisfied that the land is in excess of both present and, as far as can be judged, future requirements, Government purchases it and leases it to the applicant. In this case the interview with the many owners took place in the "House *Tamboran*" or men's council house, for the reason that the procedure was new to every one, and at least two hundred men assembled. The District Officer sat near the *Numun Tugut*, which was a stool carved out of a block of wood with a quaintly carved figure of a man as a back-rest. The stool is used when any important matter is discussed, and each speaker "casts his vote" by saying his say and then striking the stool with the red leaves of a certain shrub. The *Tamboran* or spirit carved on the back-rest ensures that he does not change his mind.

The interpreter addressed the gathering and expressed the desire of the District Officer to know what decision had been arrived at concerning the application by the mission. When he had finished there was silence for quite a time. Abruptly an old man arose, spoke a few sentences, struck the stool with the leaves, and then strode out of the house. Without another word the gathering silently dispersed. The interpreter stood with a frightened look on his face, and, when questioned by the sergeant, replied that he had not understood what had been said. Later on, in strict privacy, his interpretation of the old man's words were: "Several days' journey up the river there is a white man, the District Officer. Several days' journey downstream there is a white man, the missionary. That makes two. Two too many." It was not until some years later, when a large number of young men had returned from indenture, and could appreciate the fact that material benefits would follow the advent of a European settlement, that the land, which was very much in excess of requirements, was parted with.

There was a final flicker of the old spirit when in 1927 one village on the river itself raided another and took eighteen heads; but the prompt arrest, trial, and hanging of seven of the ringleaders, together with the varying terms of imprisonment inflicted on others, has put a final stop to head-hunting on the river. Patrols have been working back from the river for some years; but it will be very many years before the district has been covered entirely.

In addition to the main stream, there are several important tributaries which flow into the Sepik not far from its mouth, and in 1925 a patrol on the Keram river, the most important of these, was met by a deputation which desired assistance.

Five days previously the *luluai*, with his wife and her brother, had gone to fish in the lagoons at the rear of the village, and had not returned at nightfall. A search party next day had discovered the canoe, which had been deliberately smashed up. Bloodstains on the canoe and the nearby grass left no doubt as to

the fate of the fishers. Judging by signs, the raiding party had also been in canoes.

About 6 miles away, across a sea of grass, could be seen a clump of swamp timber, and the raiders were said to have their village somewhere in this. As the water in the river, and consequently in the lagoons, had fallen about 10 feet in the past few days there was practically no open water, and the patrol (the District Officer and eight native police) was unable to use canoes. Rations and light camp gear were accordingly made up in loads of about 50 lb., each load being slung on a pole for two carriers. As they set off across the matted grass, an undulating movement underfoot led to the discovery that a great area was floating on water. The grass mat proved to be 4 or 5 feet thick; but as the longest available pole was only about 12 feet, the depth of the water underneath was not determined. The carriers soon got into difficulties, often sinking into the grass up to their crutches, and having to flounder for some minutes before getting out. As far as possible, police and carriers advanced at intervals of not less than 10 yards, and on several occasions detours had to be made where the undulating movement had caused the grass in weak places to split, and open water to show. However the 6 miles were covered in eight hours, and as the patrol had set off at 5.30 a.m. there was still time to locate the village before dark. It was astonishing that the patrol had not been seen by a sentry; but it was discovered later that the village had fancied itself isolated by the falling of the flood waters. A man, his wife, and two children, who all happened to be in a house a little removed from the village, were captured; but not before the alarm was given. The village, when reached, was found to be deserted, and nothing could be done that night. Next morning the curiosity of a constable, who wondered what several *kanaka* fowls were picking at in a canoe lying on the tops of posts some 10 feet high, led to the discovery of the bones of the lost fishing party. A few hours later the patrol was ambushed while searching the sago swamps. One spear passed through a constable's arm and then fortunately broke on his leather belt. Another passed through the officer's clothing and inflicted a nasty bruise. Though there was no sign of an assailant the police opened fire in several directions, but without apparent result other than that no more spears were thrown. The swamps were deserted for the next few days and the patrols did not find any fresh tracks. One morning, just before daylight, there was a hail from the bush surrounding the village clearing, and the *luluai's* brother was able to speak to the unknown. In view of the fact that only three people—the *luluai*, his wife, and her brother—had been killed by them, and as the police had shot seven men in the ambush, was the Government willing to call the fight off if the people all came in? The Government was very willing to do so. During the day about one hundred and fifty all told came in, though still very fearful. In this particular area, which the District Officer's map showed as "Grass and swamp, believed to be uninhabited," over two thousand natives were visited within the next few months. Recruiters were quick to enter the villages, every one of which is now under complete Government control.

The discovery of gold in Morobe district in 1926 forced the District Staff to abandon all prearranged plans for penetration and developmental work.

Gold was discovered in virtually unknown country, and the large influx of miners and prospectors, the majority of whom had had no previous experience with natives, placed upon field officers the heavy tasks of ensuring their safety where they were working, and endeavouring to bring the inhabitants of the surrounding country under influence in anticipation of miners and prospectors pushing out farther afield. Although there were no villages within 10 miles of the actual gold find itself, the track from the beach at Salamaua to the field at Wau and Edie Creek led through a number; and it was inevitable that some thieving of field fruits from the gardens would be done by the indentured labourers carrying in supplies. This led to attacks by the garden owners, and there was continual friction until the introduction of aerial transport solved the carrying problem. Aircraft now do the trip from Salamaua to Wau in twenty-five minutes, a journey which took carriers seven days, the lowest pass over the mountains being at 5500 feet. For some time mining activities were confined to Edie Creek and Wau, two small areas, and this gave the Field Staff a little breathing space in which to proceed towards the spreading of Government influence in outlying villages. But in less than a year several companies were formed which took over the individual holdings, and so led to a great extension of prospecting. Men pushed down the Bulolo river and then crossed the range on to the Watut river, roughly parallel to the Bulolo. The native population was considerable and distinctly hostile from the beginning. Carriers bringing in supplies to isolated camps were robbed and beaten, and, in several instances, killed. It was impossible to obtain interpreters, as none of the coastal natives had ever been in touch with the inlanders. A police post was established at Surprise Creek, near the head of the Watut, at an elevation of 3500 feet, and, after considerable difficulty, a landing-ground for aircraft was constructed. It was in a hollow between two mountain spurs which run down to a river gorge 80 feet deep. As the hollow was rather saucer-shaped, about 30 yards of the lip on the river side was cut away. To alight, the machine flies over the gorge and through the small gap and puts its wheels on the ground as quickly as possible, the bottom of the saucer being only about 30 yards wide. The other side of the saucer slopes sharply uphill, and the machine very quickly pulls up. Before it stops however the machine is turned sideways to prevent it running backwards downhill. When taking off from this ground, natives pull back on the struts on both wings, and the pilot puts his wheel brakes hard on. The engine is then revved up fully, and at a sign from the pilot, who then takes off his brakes, the strut of the wing lying uphill is released. The machine swings at once, owing to the drag on the one wing, and at once bolts downhill. At the gap the machine is lifted off the ground and at once swung over the ravine, thus gaining 80 feet in height. A full load of 600 lb. is always taken in, but no more than 300 lb. can be taken out. Every landing on this ground may truthfully be described as a "forced landing"; an average of two landings are made daily throughout the year. For over twelve months the post at Surprise Creek was fully occupied in guarding the half-dozen scattered miners and in trying to gain the confidence of the surrounding natives who came into the camps, mainly to steal. Quite recently two prospectors who ventured out without consulting the officer at the post, had travelled only 10 miles when they were ambushed and, with five of their nine

carriers, clubbed to death. The task of finding the murderers in that mountain country will take at least three months.

When the District Officer considers that, unless the natives are provoked, the lives and property of miners in a certain area can reasonably be considered to be safe, a site for a new post is determined. The District Officer and the officer whose duty it will be to establish the post make an aerial reconnaissance and select a likely looking patch of ground for a landing-ground. The pilot, who will have to land on the ground, is naturally consulted. The country between the selected spot and the nearest post or landing-ground is carefully surveyed and the inward route mapped. The route should be as short as possible; but should avoid villages. When the patrol has been out the number of days it was anticipated it would take to reach the new post, a machine flies out with tools and rations, which are dropped if the signal is received that the ground is suitable for the purpose required. The patrol then signals the number of days needed to prepare the ground for a machine, and at the agreed time the District Officer lands there. Having no worry about supplies or reinforcements—a signal laid down will always bring a machine—he can begin the visiting of nearby villages at once.

With one exception, District Officers are proceeding with carefully laid plans for the development of their districts, and recruiters and missionaries are well satisfied to tread the path made by the Field Staff; but in Morobe District the task of the Field Staff is to keep one move ahead of adventurous miners, prospectors, and recruiters, who, notwithstanding the anxiety they cause, should be given full credit for their share in influencing the native to trust in the white man's Government.

A ROMAN BRIDGE IN THE FENS

E. J. A. KENNY

Map references: O.S. 1-inch Sheet 65, Wisbech and Kings Lynn; O.S. 6-inch, Norfolk, Sheet LXVIII, S.E.; O.S. 25-inch, Norfolk, Sheet LXVIII, 12.

THE great gravel road which ran through the Fens from Denver in Norfolk to Peterborough has for long and with good reason been recognized to be a Roman road. Dugdale, in speaking of it, says: "Neither is that long causey made of gravel, of about three feet in thickness, and sixty feet broad ... which extendeth itself from Denver in Norfolke (near Salters-lode) over the great wash to Charke; thence to March, Plantwater, and Eldernell, and so to Peterborough, in length about xxiv miles, likely to be any other than a Roman work, as may seem from the words of Herodian in the life of Severus the Emperor; ... 'He therefore [viz. Severus] first took care to make causeys over the fenns, that his soldiers might stand on firm ground, and with ease passing over them, fight on the dry land' " (Dugdale, 'Imbanking and Drayning,' ed. 2, p. 174). The passage of Herodian referred to is III, 14, 5: *μάλιστα δὲ γεφύρας ἐπειρᾶτο διαλαμβάνειν τὰ ἑλωδῆ χωρία, ὡς ἂν ἐπ' ἀσφαλοῦς βαίνοντες οἱ στρατιῶται 'ραδίως τε αὐτὰ διατρέχοιεν καὶ ἐπ' ὀχυροῦ βήματος ἑδραίως*

ἑστῶτες μάχοιντο. Nor was it only a road for the army on the march; from Peterborough there was a way north by water and land to York and ultimately to the Wall, so that the legions could be fed in case of need on corn from the Fens and Norfolk. It is not unreasonable to see in the famous Car Dyke, which is traditionally of Roman origin, the continuation beyond Peterborough of this ancient corn route to the north.

Beloe, the solicitor of Lynn, wrote a paper on the road, in *Proc. Cambridge Ant. Soc.* 1889. He does not contradict the statement of Dugdale that the causeway is 60 feet broad, so that he must be supposed to have accepted it. Moreover, as if in confirmation of his own words (p. 120), "I am not a scientific man," he gives no indication of the breadth of the road in any of his sections. Nor has he given sufficient details to allow of the identification of the points where he took his sections. These facts, together with his lamentable ignorance of the soils of the Fens, render his work on the road utterly useless to the serious student.

The course of the road is marked on the Ordnance maps as far as it was known at the time of the last revision. The line is not complete for the whole distance, but the fragments of it are sufficiently large and sufficiently numerous to allow of the intervening portions being restored. To do this with accuracy requires a careful examination of the actual territory, but a good general idea can be got from inspecting the 1-inch map (Popular Edn. Sheets 65 and 64). The 6-inch scale however is naturally to be preferred, and references will hereafter be given to the sheets of the 6-inch map. Where the road runs east of Denver is not known. It can be traced from the west bank of the Hundred Foot Drain or New Bedford River to the suburbs of Peterborough. It runs first south of the Downham Market–Nordelph–Ely road as far as Lot's Bridge, where the Ely road turns south (O.S. 6-inch, Norfolk LXVIII, S.E. and S.W.). Between the village of Nordelph and Lot's Bridge the Roman road is never far from the modern one. Then its course is east of March, through Eldernell to the village of Coates, the main street of which is probably built upon it. Then it turns towards the north, and a fragment in the middle of a field west of Coates and north of Eastrea (O.S. 6-inch, Cambs. X, S.E.) gives its direction, and indicates that it is to be found in Bassenhally Road and Stonald Road, Whittlesey. Farther on in the same line it underlies the Low Road in Stonald Field (O.S. 6-inch, Cambs. X, S.W.). Beyond this the road is lost in the washes of the Nene on the outskirts of Peterborough. Those who would connect the Road and the Car Dyke as parts of a great land and water route to the north have not far to seek for the end of the Dyke. According to some the dyke comes down to within 2 miles of the last recognizable part of the road, near the Fengate of Peterborough and the great Neolithic and Iron Age site in the gravel pits just to the north. There is at the present day little to indicate to the casual observer where the road is. For the whole of its length it is below the surface of the ground, and modern roads and tracks follow it only for short distances. In arable land the gravel has ploughed up to the surface in many places, and is very conspicuous in the stoneless silt. Ditches and drains give a view of the road in section if their banks have been recently cut back. The normal width of the road is from 15 to 18 feet, and the gravel is from 2 feet to 3 feet 6 inches thick. In some places the farmers have

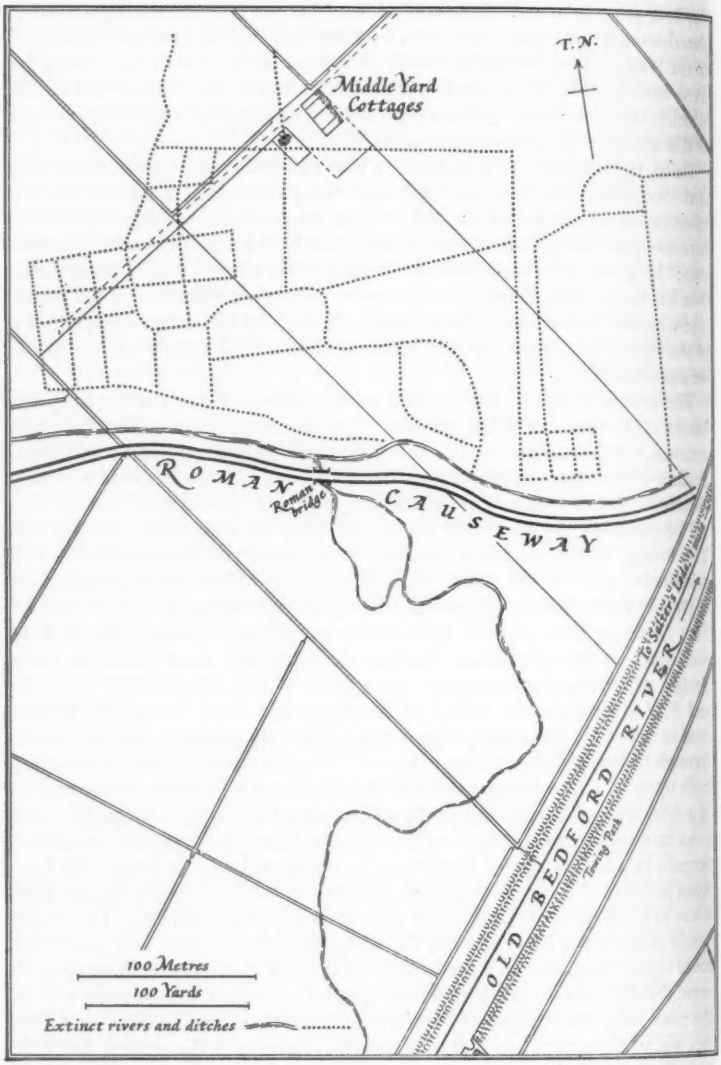


Fig. 1. Position of the Roman bridge and reconstructed river system

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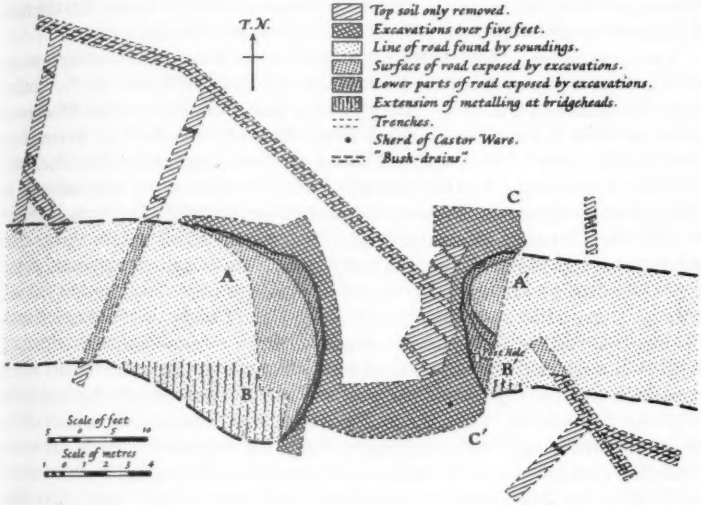
1. *Aerial photograph (from a height of 6000 feet) of the neighbourhood of the Roman bridge, showing extinct watercourses*

2. Bridge abutment: western trench

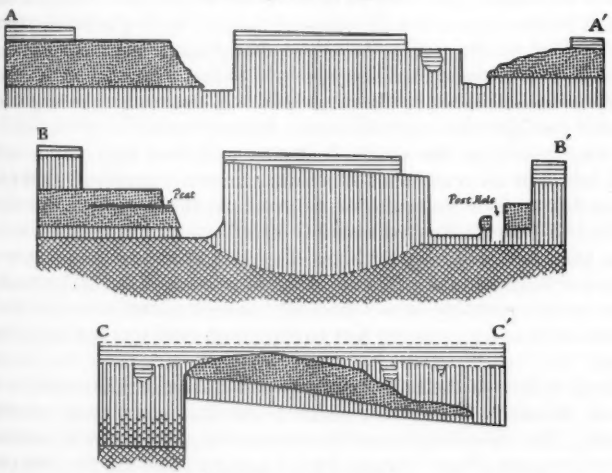
3. Bridge abutment: eastern trench

4. Top soil removed from side of eastern trench, showing black markings

Plan of Roman Bridge Abutments at Nordelph.



Sections from above plan



Reference to symbols on sections.

Top soil. Silt. Gravel. Silt mixed with clay. Peat.

Scale of feet 5 0 5 10

Scale of metres 1 0 1 2 3 4

(Sections are twice the scale of the plan)

Fig. 2

dug away the gravel, which is of excellent quality, in order to use it for their own roads and paths. The only trace of the ancient road that then remains is the scattered gravel that escaped them; with the result that the road is difficult to follow through plough, and impossible through grass.

The most easterly point on the road which is marked on the Ordnance maps is its intersection with the west bank of the Old Bedford River. In November 1931 the road was traced by Major Fowler and myself across the Washes as far as the west bank of the Hundred Foot Drain or New Bedford River. In a note on this part of the road, published in *Proc. Cambridge Ant. Soc.*, vol. XXXII, 1932, Major Fowler accounts for the breadth of 60 feet assigned to the road by Dugdale and Beloe on the assumption that they had both confused it with the silt banks of certain extinct waterways which it follows for considerable distances near Nordelph and March. These extinct rivers are of the type described by Major Fowler under the name of "roddons" in this *Journal*, vol. 79, p. 210. It will not be out of place to recall briefly their characteristics, for the river that the bridge under discussion once crossed is now a roddon. A roddon in its present form is a raised bank of laminated silt or shell marl which runs in a meandering course through the Fens. These banks represent the alluvium deposited by the rivers in their channels. The raised position of the banks relative to their surroundings is due to differential shrinkage. The surrounding peat has shrunk by reason of the intensive drainage of modern times, while the silt or marl of the river-bed has not shrunk, with the result that what was once the bottom of the river is now the top of the roddon, for the raised banks of the stream have been let down by the shrinkage of the peat beneath them. A further note on the shrinkage of the peat by Major Fowler appeared in the *Journal*, vol. 81, p. 149. It is there shown that the shrinkage of the peat in Denton Fen between 1848 and 1932 was 10 feet 8 inches (3·25 metres). It has now been established by the investigation of this bridge site that one class at least of roddons were active streams in Roman times.

At some points the line on the Ordnance map does not coincide with the actual course of the road. This is not due to error in surveying, but to other features having been mistaken for the road. At the intersection of the road and the Old Bedford River the road is placed too far to the north, a roddon having been mistaken for it. A short distance to the west of the excavation, and west of Birchfield Farm (O.S. 6-inch, Norfolk LXVIII, S.E.), a prominent surface feature, probably an ancient canal, has been plotted instead of the road, which is often as much as 300 feet farther south and does not appear on the surface.

The excavation of the bridge site was undertaken at the instigation of the Fenland Research Committee, which body also contributed towards the expenses. The Vice-President of the Committee, Major Fowler, showed me an air photograph (Plate 1) from which it appeared that the road was cut by a roddon at a point 400 yards west from where it crosses the Old Bedford River. He and I then made a preliminary examination of the site, and found, by sounding with an iron bar, that the road was interrupted at the point where it crossed the roddon. The natural conclusion to draw was that the roddon was an active stream at the time when the road was in use, and that excavation would reveal the remains of the bridge by which the road was carried across the

stream. This examination took place in November 1932. I carried out the excavation at the beginning of February 1933 with the assistance of Mr. R. W. Hutchinson, of St. John's College, Cambridge. For permission to dig we are indebted to Mr. Johnson, of Middle Yard Cottages, who farms the land. We are also grateful to Mr. Graham Noble for his assistance.

A trench was dug to expose the western abutment of the bridge, where the road came to an end on the west bank of the roddon (see Plate 2 and Plan). The crown of the road was found to be covered with about a foot of cultivated silt. There is no substruction of any kind below the road: the gravel rests directly on the silt. For an inch or two below the gravel the silt seems to be slightly clayey, but this may well be a fortuitous effect. The abutment of the bridge on this side of the roddon is steep and has sharp angles; its width is 20 feet. A second trench was dug to expose the end of the road on the eastern side of the roddon (Plate 3). The abutment on this side of the river is much less steep than the other, and presents a rounded outline: it is also narrower, being only 15 feet wide. Section AA′ shows the form of the abutments, as seen from the north. In the second trench was found a Castor ware sherd of a late type, lying in the silt of the roddon 6 feet below ground-level.

These two trenches were joined at their southern ends by a third trench, which was 8 feet wide and was dug down through 7 feet of silt and then 6 inches of clay until it reached the peat underlying the roddon. Two dams were used to keep the workings from being flooded. Nothing was found in this trench, but it served to indicate the shape of the roddon bed. The eastern trench was extended westwards at its northern end by an excavation 7 feet 6 inches deep and 6 feet wide for a total length of 17 feet. This trench also was unfruitful, except in so far as it gave further information about the roddon bed.

The distance between the abutments of the bridge is 20 feet at the point where they are nearest together. The highest point of the western abutment is 15·8 feet above the Newlyn datum of the Ordnance Survey: the eastern is 0·61 foot lower. The material of which the abutments are made is the same gravel as was used for the metalling of the road. On account of its high ferruginous content it binds well, and has set as hard as concrete, with the result that the outlines of the bridgeheads are well defined, and the angles sharp. No traces of any timber structure were found: the probability is that the timber floated away during a flood. On the east side of the river two post-holes were found. One was on the south side of the road, and passed through an extension of the bridgehead, of which more will be said presently. This post-hole was of well-defined rectangular form, and measured 1 foot east and west by 1 foot 3 inches north and south. The other post-hole touched the end of the gravel towards the north side of the road: it was less distinct in its outline than the first, but could be seen to be circular, and about 1 foot in diameter. No post-holes were found west of the stream. It will be seen from section AA′ that the abutment on this side is more suitable for supporting directly the timbers of the bridge than is that on the east.

In the eastern trench there appeared in section immediately below the surface soil what looked at first like sleeper beams, varying in width between 4 inches and 1 foot (Section CC′). They seemed worth investigating, so, as a first measure, the top soil was cleared as far as the top of the virgin silt over an

area some 4 feet wide adjacent to the eastern trench on its western side (Plate 4). This exposed the markings as black lines running through the silt at an angle of about 40 degrees to the line of the road. They did not seem to be very relevant to anything, but nevertheless it was decided to follow up the widest of them, which was also the deepest. Accordingly a trench was dug through the top soil, and the course of the marking traced in a straight line for 50 feet north-west; then it turned southwards, towards the road west of the western trench, through an angle of about 25 degrees. It was followed in this direction for a further 24 feet without the end being reached. From this long trial trench two trenches were dug towards the road. The first was carried right across the road, and the second, in two branches, only as far as the north side of the road. These trenches, which were cut only as deep as the top of the silt, crossed other black lines of a similar character to that in the long trench. Other trial trenches to the east of the eastern main trench also revealed black lines in the top of the silt. Sections of the marks were taken, and it was finally concluded, with some hesitation, that they represented the courses of decayed modern "bush-drains."

On the south side of the road at both bridgeheads the road metalling widens out to nearly twice the normal width of the road, and slopes down to the river, falling between 2 and 3 feet to the outer edge. On the west, where the abutment has a steep face, the slope is gradual; on the east, where the abutment is rounded, there are two steps clearly defined (see Plan and Section CC'). The rectangular post-hole mentioned above passes through both steps (Section BB'). The extensions of the bridgeheads show that the river was crossed by a ford as well as by a bridge at this point. There is no need to assume that the bridge and the ford belong to different periods, for the two things exist together commonly enough. In this case however it may be argued that the ford cannot have been in use at the same time as the bridge which was associated with the rectangular post-hole, because the post-hole cuts through both steps. Thus we have a time when the ford was superseded by a bridge, but there is nothing to show that there may not have been both bridge and ford in use together after, as well as before, the time when there was only a bridge.

It will be seen from the map of the site that the river which the bridge crossed ran at once into a larger stream. It is on the south bank of the larger stream that the road was built. The collapse of the bank as the river became a roddon has tended to accentuate the slope of the road to the south. This roddon is in all probability one of those which led Dugdale to the conclusion that the Roman road was 60 feet broad. The road follows the roddon for $2\frac{1}{2}$ miles westwards from the Old Bedford River, until the roddon turns northwards to the aqueduct at Mullicourt, where the Well Creek passes over the Middle Level Main Drain. The features shown on the map can easily be recognized on the air photograph. The most readily seen are the roddon which cuts the road, and the roddon of the larger stream on the bank of which the road was built. The roddons appear as dark lines: the road is a light line, and is less easily seen. The bridge is at the junction of the two roddons near the middle of the photograph. The smaller roddon, coming from the south-east, can be seen cutting the road. Both roddons and the road can be seen on the ground, though to a ground observer the road is much clearer since the gravel has ploughed out and shows red against the

black earth. It may perhaps occasion surprise, in view of the popular notion on the subject, that the road, although a Roman road, is not straight. The reason for this is quite simple: the road follows the bank of a river in this place, and a river bank cannot be straight. Farther to the west, on the higher ground, the road is straight enough.

Connected with the larger stream is a complex series of ditches forming rectangles in the fields adjacent to the excavation on the north side. These show up in the air photograph as dark lines of the same character as roddons, and with equal distinctness. On the ground however they are quite different; they have no raised bank, but are only lines of black peat in the silt. If the field is down to sugar-beet the roots grow to a great size in these runs, as they are called. The tendency of this crop to root large in peat is well known to Fenland farmers. Such is the appearance of the ditches in arable fields; where they occur in grass fields they scarcely show in an air photograph at all, but are much clearer on the ground. They still retain, in grass, their original appearance as ditches. The size of the rectangles formed by the ditches varies from 80 feet square to 100 feet by 200 feet. The ditches are contemporary with the rivers and the road: that is to say they were the ditches which enclosed and drained the fields of a Romano-British village. The site of the village can be seen in the angle which the Roman road makes with the Old Bedford River. The modern drainage dyke which crosses the road just east of the excavation shows in its sides a section through several floor-levels of the ancient huts. In the triangle enclosed by this dyke, the Roman road, and the Old Bedford River, a dark spot can be seen on the photograph, which represents the site of a cluster of huts destroyed by fire. A considerable number of sherds was found on the surface and in the top soil on the village site, which has not yet been investigated. Of these sherds Mr. Christopher Hawkes, of the British Museum, says: "The pottery forms a series beginning in the second quarter of the second century, and lasting till the fourth, perhaps till the second half of the fourth. Though early coarse-ware types were retarded in this district, the second century is still better represented than the later Roman periods." From this we may conclude that the road was already in existence by the time of Severus, having been constructed in the first half of the second century.

GEODESY AND GEOPHYSICS AT LISBON

THE Fifth General Assembly of the International Union of Geodesy and Geophysics was held at Lisbon between September 14 and 23, spaciously lodged in the Palacio do Congresso. The weather was fine, if rather hot; the spontaneous hospitality of the Portuguese hosts had only the defect that it was perhaps excessive, and made work difficult; and the attendance was, for a time of financial crisis, exceptionally good. The President of the Union, Monsieur Ch. Lallemand, maintained to the last day of his term of office that air of grace and distinction which has made him during the whole life of the Union an incomparable President, hardly replaceable. The President of the Republic honoured the Union by presiding at the first plenary session, and on the last day of the assembly received the delegates in his Presidential Palace at Belem. The Minister of Public Instruction, the Municipality of Lisbon, the Ministers of Commerce and of the Navy, the Director of the Geographical Institute, the Geographical Society, and the Société de Estoril vied with the Portuguese National Committee in splendid hospitality; and the President of that Committee, Professor Da Costa Lobo, who had inspired the whole, took the survivors of the Assembly to his University of Coimbra, as a prelude to the excursions which followed the meeting. It was a great regret to most of the British delegates that they were not able to accept the Coimbra invitation.

The Union is divided into seven Associations, of which Geodesy makes by far the largest, and this brief account of the proceedings must be restricted to the doings of that Association. Its President should have been Dr. William Bowie, but it was known some weeks before the meeting that he could not be present. Rumour had it, indeed, that the United States had withdrawn from the Union; but the truth was far otherwise. As part of the Recovery programme the United States Coast and Geodetic Survey had been given so much money to spend that the chief of its Geodetic Division was too busily employed in spending it to be able to find time for a long journey. The Vice-President, M. Gautier, and the senior member of the executive committee, General Vacchelli, had died since the Stockholm meeting, and the duty of presiding passed to General Seligmann, chief of the Belgian delegation.

The report of the General Secretary (General Perrier) sets out with his usual lucidity the story of the Union and the Association since the Stockholm meeting in 1930. No new country has adhered to the Union, but several have retired: Australia, French Indo-China, British India; and nothing has been heard of others. The unit of contribution was increased in 1930, and for the time being the financial situation of the Association is good; but it has heavy commitments in publication, and the future is not without anxiety, since there are arrears of contributions, and the Union is faced with demands for relief, on pain of withdrawal. The old International Geodetic Association had in 1913 an income of 88,000 gold francs; the present Association received as its last annual share of the funds at the disposal of the Union only 58,000, or about £2300 gold pounds. It is remarkable how much the General Secretary has succeeded in doing with this relatively small sum.

The scientific work of the Association is entrusted to the care of many

Commissions, whose recommendations are made to and almost always accepted by the plenary session of the Association, which in turn transmits them when necessary to the States interested, and sometimes with gratifying success. The remarkable work of Dr. Vening Meinesz in determining the intensity of gravity at sea, by observations in a submarine, had been discussed at successive meetings of the Association, but before 1930 only the United States had followed the lead of Holland in this new and most important matter. At Stockholm the Association resolved to approach again those States with submarines at their disposal. Italy responded at once, and it is now announced that France has engaged herself to follow. The progress is slow, and it is important to note that in each case Dr. Vening Meinesz has himself installed his own apparatus on the submarine and trained the observers where he has not done the work entirely himself. That has been greatly to the advantage of geodesy, but it is a process which cannot continue indefinitely, and the time has surely come for the principal nations to shoulder their own responsibilities in gravity survey at sea.

Another enterprise of the first importance is the Arc of Meridian from the Arctic Ocean to the Mediterranean and its junction with the 30th meridian arc in Africa. Owing to the illness of Colonel Beneš, who was Secretary of the Commission, there was no report of progress in print before the meeting, and we are unable to say what happened in the Commission. But there are indications in the general reports on triangulation and base measurement that the business is proceeding. Poland has made junctions with the triangulations of Lithuania and Czechoslovakia; Romania has been at work on two of its meridian chains which form part of the scheme; and Greece has measured a base in Crete and attached it to the Greek triangulation. A valuable summary of the state of the 30th meridian arc in Africa was presented by Captain McCaw. Its length is 6750 km., of which 3600 are measured, 480 are in process of measurement by a British party in Tanganyika, and 2670 are unmeasured, of which 2025 lie in the Anglo-Egyptian Sudan, and 295 more in British territory farther south.

Among new proposals made to the Association was that of Professor Bonsdorff, for the standardization of European base-lines. With the modern invar tape suspended in catenary it is easy enough to measure bases with an apparent accuracy of one part in several million, as deduced from the internal agreement of the measures; but the real uncertainty, inherent in the laboratory standardization of the bars and tapes, is much more like 1 in 500,000. Professor Bonsdorff proposes, as the result of long experience in the operations of the Baltic Commission, that each country should measure a standard base of about a kilometre, and that the Association should select three of these bases and intercompare them rigorously, taking their mean as standard. Every country would then be able to compare its own standard base with this international standard, and so control its tapes and its bases without the delay and the doubt of laboratory examination. We should thus establish a new standard of length related as closely as possible to the international metre, and at the same time much more practical and ensuring much greater homogeneity than can be obtained by the present methods. It is a proposal which demands and will doubtless receive the most sympathetic consideration. And it has the great advantage

that it is already in practice on a smaller scale in the operations around the Baltic, so that its effects may be studied.

At Lisbon for the first time the national reports were taken as read, and delegates were at liberty to choose from the piles instead of having volumes thrust upon them by circulating attendants. Conscientious delegates accumulated the same mass of paper as before, but few will have found time as yet to study the contents. We must confine our attention here to the British report, which took the form of a Professional Paper of the Ordnance Survey, New Series No. 15, entitled "Further Notes on the Geodesy of the British Isles, including Geodetic Surveys of the Crown Colonies." In Chapter I on Great Britain it deals with a recomputation of one figure in the Principal Triangulation; a study of the expansion of invar wires and tapes; a method of carrying levels across estuaries by simultaneous observation of vertical angles by modern precise levels; observations for a mean sea-level at Newlyn and Dunbar since 1913, and at eleven other stations in different parts of the world; gravity observations at fifty-three stations in Great Britain, partly by Mr. Bullard's new method which eliminates the chronometer; a study of invar pendulums in magnetic fields; and important developments in precise time-keeping due to the National Physical Laboratory. There is a good plate showing how gravity anomalies, which are small in England, grow steadily greater in Western Scotland and the Hebrides, and a striking comparison of Kater's determinations in 1818 with the recent results, much to the credit of Kater. Chapter II deals with recent geodetic work in Palestine, Ceylon, Malaya, and Hong Kong, and Chapter III with the arc of meridian 30° east, its recent extension in Tanganyika, and the primary triangulations of Nigeria and the Gold Coast. The last chapter is a brief account of work in British Honduras. Not all this was done in the period 1930 to 1933, but the most important was, and it makes a pleasant contrast with the three gravity stations which were all the British had to report at Stockholm.

As examples of the General Reports which are made to each meeting of the Association by special reporters we may take General Perrier's on Triangulations and on Bases. In the first he remarks that twelve countries only have sent replies to the questionnaire addressed to them, and that to his knowledge some of the defaulters have done important work which they should have brought to the knowledge of the International Union to which they adhere. He notes the rapidly increasing use of the Wild geodetic theodolite, and of electric lamps operated by dry batteries for night triangulation; and he deplores the fact that several countries who are in the early stages of their triangulation have nevertheless not based their calculations on the International Ellipsoid (Madrid, 1924). Greece, Hungary, Mexico, Norway, Poland, Romania, and the United States are the most active triangulators among those who have reported. During the three years covered by the report the United States measured 39 bases, Norway and Poland 4, and Greece 3.

Such are brief examples of the scientific activities which came before the Association. Of general communications made to it two must be mentioned: the lecture by Dr. Vening Meinesz on the isostatic reduction of his gravity determinations, which are better represented by an hypothesis far different

from that of Hayford, and the lecture by M. Holweck, who constructs the new gravity pendulums of Lejay. He described the improvements made in these pendulums during the last three years, and communicated the results of a long journey in China recently made by Father Lejay. Three years ago these pendulums were regarded with some doubt; their accuracy seems to be now established. The Director of the Geodetic Institute of Copenhagen had brought a set with him and spent an afternoon determining the value of gravity at Lisbon. Professor Nörlund was thus the first delegate to do actual geodetic work during one of these meetings, and he proposed to make quite a series of stations on his return journey. Father Lejay's estimate of the time required for one station: "quinze minutes, calculs compris," was not meant to be taken too seriously, but the speed and convenience of his pendulum are now beyond question, and only their high cost debars us, though not other countries, from bringing them into use.

Those who know the stature of Dr. Meinesz will appreciate the pleasantry of a delegate from Switzerland, that he is an Anomaly with an error of sign: Dr. Minus instead of Dr. Plus. The error did not disqualify him from election to the Presidency of the Association, in succession to Dr. Bowie, who was elected President of the Union at the concluding plenary session, to hold office until the end of the next General Assembly, at Edinburgh, in 1936.

A. R. H.

THE EMPTY QUARTER OF ARABIA

THE EMPTY QUARTER: being a description of the Great South Desert of Arabia known as Rub' al Khali. By H. StJ. PHILBY. *London: Constable & Co.* 1933. 9×5½ *inches;* xxiv+434 *pages; illustrations and map.* 21*s*

READERS of this *Journal* must be generally familiar with the several valuable contributions which Mr. Philby has made during the past twelve years towards the geography and exploration of Central Arabia, but as he would have us believe that his ambitions in that direction are fully satisfied, it may be well, in dealing with his latest achievement, to recall the circumstances of his first introduction to Arabia and the junctures at which his successive expeditions have been carried out.

It will be remembered that he was one of the several experienced Indian Civil Servants and Military Politicals lent by the Government of India in 1917 to the Expeditionary Force opposing the Turks in Mesopotamia, to assist the Chief Political Officer in forming a civil administration for the rapidly expanding area of Turkish territory in our military occupation. For that task the uncommon accomplishment which Mr. Philby had acquired before coming—a scholarly knowledge of Arabic—made his services especially useful.

On our occupation of Baghdad in the spring of 1917 he was transferred to the Civil Commissioner's headquarters there, to organize his Secretariat. In October of the same year, when it was decided by the powers-that-be to send a joint Baghdad–Cairo Mission to Ibn Sa'ud to see if he were now in a position to render us definite co-operation by moving against Ibn Rashid, who was still somewhat of a menace on our desert flank to the southward, Mr. Philby was

deputed as political representative and head of the Mission; and travelling *via* Bahrein and 'Uqair, reached Riyadh without incident at the end of November, where he and his companions received a cordial welcome from Ibn Sa'ud.

Thus it was that the fortunes of war chanced to turn Mr. Philby's steps towards "the heart of Arabia"; and thus was inaugurated that close and friendly association with its great Ruler which he has since enjoyed.

On the occasion above referred to the representatives from Egypt failed to keep the rendezvous; it was reported that the Sharif was not inclined to facilitate their passage to Riyadh. In these circumstances our enterprising author, scenting the possibility of combining adventure with service, suggested to his host that he himself should proceed across to the Hijaz, with an escort from Riyadh, and pilot the Cairo party back. Ibn Sa'ud readily fell in with this proposal, and Philby started without loss of time, his companions, Lieut.-Colonels F. Cunliffe-Owen and Robin Hamilton (now Lord Belhaven), Political Agent at Koweit, returning at the same time to Mesopotamia. His trek across to the Hijaz was interesting but uneventful, and when he reached the Sharif's headquarters at Taif in the latter part of December he found that venerable but obstinate potentate strenuously opposed to the object of the Mission to Ibn Sa'ud and unwilling to associate himself with it in any way, so that no alternative was left to him but to proceed on to the coast at Jidda and thence take ship for Basrah.

Referring later to his arrival at Jidda on this occasion, he wrote: "At mid-day on the last day of the year (1917) we streamed through the Mecca gate, *our goal attained and Arabia crossed from sea to sea*." (The italics are mine.) It was not until nearly three months had elapsed that he came again to Ibn Sa'ud's capital, and then only to find his host busily occupied in putting down tribal unrest within his own borders and quite unable to give his mind to plans for a campaign against Ibn Rashid; he consented however to Philby filling up his time by making a short expedition southwards, to the Wadi Dowasir and back.

Though this useful effort did not actually conclude his goings and comings at this period, while still "on duty" from Baghdad, his first book, 'The Heart of Arabia,' published in 1922, dealt only with his travels up to that point (March 1918). The happenings of the last four months of his sojourn in Arabia, during which he accompanied Ibn Sa'ud to the Qasim, in connection with the plan for a campaign against Ibn Rashid, were recounted in his second literary effort, 'Arabia of the Wahhabis,' not published until 1928, ten years after the events with which it was concerned. In the intervening period however the valuable geographical material which he had brought back had been subjected to examination and the results incorporated in the War Office 1/1,000,000 map of 1927, and in other maps prepared at our Society's House. The traveller had also been awarded our Founder's Gold Medal in recognition of his good work.

In his preface to 'Arabia of the Wahhabis' the author warned his readers of the great changes which the past decade had witnessed in "the island of Arabs"; "The Arabia I saw during this period," he wrote, "was in all essentials the Arabia of Doughty and Niebuhr. The Arabia of to-day is a very different country." And he went on to attribute the change partly to the desecrating invasion of motor transport and partly to the phenomenal development of Wahhabi power. Now, after the lapse of but five short years since those words were written, the curtain has risen on another Arabian drama, the lifting of the veil from the features of "the virgin of the Rub' al Khali"—if I may quote the words the Sultan of Muscat once used to Bertram Thomas.

Having regard to the close association, as compared with other Western Powers, which Great Britain has maintained for generations past with the Arabian Peninsula and its inhabitants, it would of course have been humiliating

had any others but Englishmen been responsible for the lifting of the veil; yet I shall be pardoned if I feel not only great patriotic satisfaction that the crossing has at last been made by my own countrymen but also personal pride in the fact that the two gallant pioneers who accomplished the feat—and that within a few months of one another—Bertram Thomas and St.John Philby, were both closely associated with me in service during the Great War. 'Arabia Felix,' in which Bertram Thomas told his graphic tale, has already been reviewed in this *Journal* (vol. 79, pp. 334, 410); 'The Empty Quarter' of his comrade is now in our hands.

The two achievements differ from each other so greatly, both in the particular circumstances of their inception and the method of their execution, that comparison cannot be justly made between them; at the same time the incidence of problems which are discussed by both makes it difficult for a reviewer to deal with one without occasional reference to the other. Before I go further let me say a word or two as to the aspect which the question of the exploration of the Great Desert, that horrid blank on the map of Arabia, which Richard Burton was so anxious to see removed, presented before the Great War to those having reason to be interested in it.

When Burton was considering the problem it was clearly a latitudinal crossing from east to west that he had primarily in mind, and until comparatively recent years I do not think the longitudinal alternative was ever seriously contemplated, at all events by any Englishman; and the reason is obvious. To make the attempt from north to south would have involved preliminary negotiations with the Turks or the Wahhabis, a course which was practically and politically out of the question. Again, for a crossing from south to north, difficult and risky negotiations would have been necessary with the tribes of the southern coastal belt; and even assuming the personal good will of the Sultan of Muscat, his writ on the Dhofar coast did not really run much outside the seaside forts where his representatives led a circumscribed existence. Moreover, under the most favourable conditions nothing could have been accomplished in one single expedition from the south or by any traveller not specially endowed.

But with the entry into the lists of Bertram Thomas and Shaikh Abdullah Philby (as he is to his Arab co-religionists), following on the political changes resulting from the War (including the elimination of Turkey), the whole aspect of the problem of the Great Desert was altered. Both the Englishmen appreciated in the first place that, other considerations apart, the actual crossing and the object of the crossing might be achieved just as well by the adoption of the longitudinal alternative as by the latitudinal; and each realized that the circumstances in which he was personally placed greatly favoured his chances of success for a longitudinal crossing, and was determined not to lose the opportunity.

Bertram Thomas during his four years as Vazier to the Sultan of Muscat had earned the close friendship and regard of the Sultan whose sympathetic co-operation he could be sure of, and he had also carefully cultivated, either during their visits to Muscat or on his own short preliminary expeditions to the south, the acquaintance of tribal Shaikhs who might be in a position to help him. He had in fact thoroughly prepared the ground and then patiently bided his time until the auspices were sufficiently favourable to justify his taking the field for his final effort. When the opportunity did come he played his cards so well and maintained such satisfactory relations with his chosen companions that without any special stroke of good fortune his scheme went through practically according to plan.

In like manner St.John Philby working from the north had succeeded in gaining the confidence and goodwill of the Wahhabi potentate, whose support meant everything to him; but domiciled as he was far away in the Hijaz, he

lacked the opportunities which Bertram Thomas enjoyed for patient preparation of the ground, and could do no more than possess his soul in patience until the royal assent to his going should be spontaneously vouchsafed—in all probability without previous warning. At last the time came, and His Majesty, stimulated perhaps by the accounts of Bertram Thomas's success of the winter before, not only invited him to make the adventure but even decided to father and finance the expedition. Philby thus found himself rather in the position of the Hunting Cheetah—his hood slipped and the quarry in sight; he must shoot his bolt instantly and hope for the best.

'The Empty Quarter' opens with an eloquent Introduction, in which the author writes feelingly of his association with the late Dr. Hogarth and of the inspiration and encouragement which he derived from that "great master of Arabian lore"; and of the keen regret which, after parting from him at Jidda, he was soon to feel at having to turn back from the Dawasir fringe of the great desert, content perhaps, as he well might have been, with what he had already achieved, but yet, as he wrote in 'The Heart of Arabia,' "never for a moment abandoning the hope of satisfying some day the insatiable craving within me to penetrate the recesses of that EMPTY QUARTER."

He goes on to tell of his retirement from Government service and his return to the Hijaz in 1924, now a free-lance, to embark on a new career in Arabia, where, before long, "the great peace of Islam" was slowly and surely to descend on him, and Mecca to become his spiritual home. But long years were yet to elapse before the opportunity for his "great adventure" was vouchsafed to him; uneven years those, years of success and failure, of sickness and ill-luck, and finally of bitter disappointment, when, early in January 1931, with his friend Bertram Thomas already embarking on his wonderful dash from the south, and Ibn Sa'ud's consent at last accorded to his own venture from the north, all his plans were brought to nought by the inability of Ibn Jiluwi, the redoubtable Governor of the Hasa province, to concern himself with the Englishman's project owing to pre-occupation with important administrative measures of his own. And so, alas, on 16 January 1931, the author had perforce to return to the Hijaz with his host, with the heaviest of hearts, at the thought that despite these long years of patient waiting he had missed the first race after all. As we know, his salvation came the following winter, but his life-history from the time of his return to the Hijaz in 1924 until then makes a moving story which can but attract the sympathy of his readers.

When the great occasion did materialize, King Ibn Sa'ud, as was to be expected, made over all arrangements for the selection of personnel and purchase of camels and supplies to his trusted viceroy above mentioned, and during the fortnight which the latter required for the purpose Philby busied himself with a further exploration of the Hasa oasis and a short visit to 'Uqair, where he was glad to meet again the King's worthy liege, Ibn Khairullah, the Governor, and to examine the ruins which Major Cheesman had suggested (and Philby is of the same opinion) must be the site of ancient Gerrha.

On January 5 he found himself back at Hofuf and everything practically ready for the start, which was in fact made on the 7th. We find the party composed, at the outset, of fifteen persons, including Shaikh Abdullah Philby, while other four were to join them a march or two ahead. Before leaving, the escort were treated in the traveller's presence to an impressive harangue by Ibn Jiluwi. Whither he would go, there were they to take him: to Jafura and Salwa, to Jabrin and Maqainama. "After that," said the Governor, "the country is beyond my ken"; but Shaikh Abdullah had also spoken of Wabar, and there too they were to guide him if they could, and even to the Hadhramaut should

they succeed in finding the individuals to whom he had given them letters of recommendation.

It is to be noted that while the personnel included a satisfactory selection from the tribes grazing into the northern portion of the desert—the Murra, the Manasir, and the Ajman, there were no representatives of those roaming the south—the Saar, the Manahil, and the Al Kathir. This was clearly a great handicap, and Philby realized it, but hoped to fall in with them later on. He did not however, and it was undoubtedly the absence of "rafiqs" from these tribes which subsequently made it out of the question for him to push through to the Hadhramaut, according to his original intention, and obliged him to alter course due west to Sulaiyil.

A word here regarding the composition of his transport and supplies—a subject of vital importance—before we follow his fortunes southwards. Of his thirty-two camels all but one were females, and one and all specially selected dune-bred individuals of the famous "Oman" breed, the true blood-stock of cameldom. Three of them were milch camels for the party's sustenance—one especially for Shaikh Abdullah's own use. The expedition was rationed for a three-months' journey, and the bulk of the material consisted of dates and rice, with a proportion of coffee, tea, and sugar, and a sprinkling of simple condiments; but no flour was included. This was a serious omission, and later on they badly felt the want of it. The fact was, I suppose, alike in the case of personnel and of supplies, that as King Ibn Sa'ud was standing the cost of the expedition Shaikh Abdullah felt bound to accept what was given him without much inquiry into details: too happy-go-lucky a basis on which to embark upon what would surely prove a perilous adventure. But the flag had now fallen and the course must be run. His first objective was Salwa, which Cheesman had visited by sea from Bahrein in 1921 and had fixed astronomically. That he had done so was fortunate for Philby for, with the disturbance of daily routine occasioned by the commencement of the fast of Ramdhan (which he though a traveller had decided somewhat unnecessarily to observe), he had let his chronometers run down; he realized however that he could remedy the lapse by taking the sun at the points which Cheesman had fixed astronomically both at Salwa and Jabrin. He made good use of his halt at Salwa, his observations leading him to the interesting conclusion that the surrounding expanse of salt flats, circled as they were by a sinuous line of cliffs, once formed an estuary from which the sea had at some time receded and thus converted Qatar which, he thinks, was formally an island, into the peninsula that it now is. From Salwa we pass on to Jabrin. There again Philby was in Cheesman's wake, but in passing from Hofuf to Salwa, and again from Salwa to Jabrin, he was breaking new ground; for Cheesman had visited Salwa by dhow only, and when making for Jabrin had proceeded due south from Hofuf, keeping along the western fringe of the great Jafura tract of rolling sands of which Philby crossed the southern section. As so often happens when two travellers approach an objective from different points of the compass, they are apt to query each other's observations and conclusions. So it is with Philby and Cheesman in respect of the Jabrin oasis; and there is one point at issue between them which is of some little geographical importance, namely the position of the adjacent hamlet of Khin, as to which they differ considerably. I fear a decision must await the visit of another traveller with time at his disposal.

Apart from this, Philby explored Jabrin thoroughly and suggests that before the desiccation of the region, when it was a thriving centre undoubtedly in touch with the sea, the oasis was rendered secure on the seaward side by the fortresses of Salwa, Dhuwaiban, and probably of Majann (which his companions held to have been situated at the mouth of the Wadi Sahba between Doha and Abu

Dthabi) and therefore its own defences only had to provide security from the land side.

Whilst the party were halted at Jabrin there came to them an interesting wayfarer from the south—one Jabir Ibn Faisal, who had left the Hadhramaut in December, but had at the moment come up from Shanna, and after secreting his small family and camels somewhere in the neighbourhood, ventured to approach the camp. By his side ran a Saluqi bitch and he carried a hare which she had just run down and which was now proffered as a peace offering. Jabir brought unfavourable accounts of conditions prevailing in the southern desert, where there had been continued drought; he had seen no sign of game for months past. He was invited to join the party at their meal that night, and having thus gained confidence, went and brought his family to pitch their camp nearby. In the morning Shaikh Abdullah went across to visit them, when he was presented with the Saluqi bitch, and the poor people, with the quixotic generosity of their kind, killed the fatted calf for him in spite of his remonstrances. Referring to his endeavour to recompense them, he writes:

"I slipped the silver (20 dollars) into the fist of the larger of the two naked sons of the house. The boy ran with it to his mother who invoked charming blessings on my head. And so we parted from our last contact with the world of men to see no more of humanity till 53 days later, when we came up out of the Empty Quarter into the inhabited world at Sulaiyil."

And so they went their respective ways, Philby with the gallant Saluqi bitch, which went through with him to the journey's end, and Jabir with a box of natural history specimens which he had undertaken to deliver to Ibn Jiluwi at Hofuf.

With their departure from Jabrin next day the party had now, as it were, crossed the Rubicon, and were entering the Rub' al Khali, the much-talked-of Maqainama being their first objective. On this stretch of their course conditions were somewhat more interesting. To begin with they met with some animal life, and picked up a number of pieces of broken ostrich shells, some belonging to the Arabian ostrich of to-day, of which a few years ago I passed on to the Zoological Society a pair which Ibn Sa'ud had sent in to me. But there were also fragments of a much more ancient shell which Dr. Percy Lowe of the British Museum identifies, after microscopic examination, with an antediluvian, or at any rate extinct, bird of the genus ostrich which must have figured in the fauna before Arabia was overwhelmed by desert conditions.

Maqainama, of which Cheesman heard a good deal, proved somewhat of a disappointment. The well had indeed a depth of 171 feet, which showed surely enough that it was the work of a more advanced civilization than at present, and in the vicinity was picked up an arrow-head from an ancient bow; but otherwise there was no trace of human handiwork, and Philby came to the conclusion that it had never been more than a desert watering-place, probably on a trade-route from Gerrha or Majann, to Mecca.

In reaching Maqainama Philby could feel that the first important item of his quest had been made good; his next objective was to be the legendary ruins of Wabar, of which more anon. But at this point in his narrative he pauses to discuss at some length the question of the standing and application of the time-honoured expression Rub' al Khali="The Empty Quarter," regarding which he and Bertram Thomas are at friendly issue. The problem is not perhaps one of general interest, but as my personal opinion is quoted by the author may I digress for a moment to make brief allusion to the subject.

It seems common ground between the two travellers that the term is one that has been familiar to geographers and the educated public in general for many

generations past, and has ordinarily been accepted as covering the whole desert area lying, longitudinally, between the fringes of Oman on the east and Nejran on the west; and, latitudinally, between the parallel of Jabrin (say 23° or thereabouts) on the north and the steppes of the Hadhramaut on the south. Both travellers alike have used it in that comprehensive sense without qualification in their previous writings, and that at any rate is its undoubted signification for those at a distance; but their experience of close contact with the region has prompted both travellers to revise their understanding of the expression. Thus, Bertram Thomas tells us—and this was Cheesman's experience also—that the Arabs with whom he came in contact during his travels did not seem to know and, at any rate, did not employ the term at all. Philby, on the other hand, states that the term was familiar to his companions, but that they employed it in two distinct senses, firstly in its general and comprehensive signification referred to above, and secondly, in a restricted sense and with reference *par excellence* to "the waterless tract," lying west of Naifa (say long. 52°).

For the general reader the issue is clearly an academic one which does not admit of authoritative decision; but it seems to me unsafe to base any conclusion one way or the other on an inconstant factor such as the presence or absence of water; for a tract that was waterless and grassless in one season might well be lavish of water and grazing in the next; and supposing that Philby had succeeded in pushing due south to the Indian Ocean as he originally hoped to do, he would surely have regarded the accomplishment as a crossing of the Empty Quarter no less than he does his passage from Naifa to Sulaiyil.

Speaking as one of the interested public, it seems to me that for us the position is that two doughty fellow countrymen of ours, each by a splendid *tour de force* and from opposite points of the compass, have at last succeeded in lifting the veil from the long-hidden features of the Rub' al Khali. As far as we are concerned we may well leave it at that.

On January 28, after three days' march eastwards from Maqainama, the wells of Bir Fadhil were reached, and from there his guides suggested making southward again to a well which they called "Umm al Hadid," "The mother of iron." Shaikh Abdullah naturally pricked up his ears, suspecting that this might turn out to be the reputed site of Wabar; and taking that route forthwith soon has to tell of the dramatic arrival of his party at the exposed crater which, he is convinced, must be the origin of the so-called "ruins" of an ancient city of that name.

The subject of Wabar, it will be noted, affords another field for marked difference of view between Bertram Thomas and St.John Philby, the former challenging alike the nature, the site, and the spelling claimed for it by the latter. In this connection it seems doubtful if either of them when they expressed their views had seen the long and interesting article under "Wabar" in the Encyclopaedia of Islam. The interpretation of the term given by the learned author in his opening sentence is as follows: "A district and tribe of the earliest period in the southern half of Arabia"; and the views of the various authorities quoted seem to indicate that when used topographically the term was applied not only to particular districts but even to the whole of the central tract between Jabrin and the Hadhramaut. If the latter interpretation is well-founded the Rub' al Khali may yet have many secrets to surrender and treasures to disgorge!

Disappointed as he must have been to find that the famous ruins of the legend were but a group of volcanic craters (as he then believed them to be), it was satisfactory at any rate for him to feel that he had disposed of the myth, and having stowed away the lump of iron and specimens of flint implements and slag which he had collected in the vicinity, he lost no time in loading up for a long and trying stretch of 200 miles southwards to Shanna. Unfortunately, for

some days now the attitude of his companions had been causing him considerable misgiving, and he realized that he was going to have great difficulty in getting them to face the final push from thence to the coast; especially if they did not succeed in finding "rafiqs" from the southern tribes to pilot them through.

To discount this contingency he sent two of his men on ahead towards Shanna to seek one or other of the Shaikhs to whom he had letters and with orders to rendezvous with him again in six days' time; but they returned without success, and by the time the party reached Shanna it was clear to Shaikh Abdullah that he must now make a bold announcement as to his further plans. All chance of getting through to Dhufar was at an end, and he must decide on some alternative plan while refusing absolutely to fall in with any scheme for returning on his tracks to Hasa. Accordingly, he proposed that they should strike south-westward with the idea of reaching Qabr Hud, the famous Hadhramauti shrine of which we have had such graphic descriptions recently from Wing-Commander Cochrane of the Air Force at Aden. Once there it would be easy enough to reach the coast at Makalla. The tract of country in question would have been a valuable one to explore, but he found it impossible to induce his men to go farther south in any direction, and was reluctantly obliged to accept the alternative, which he himself finally suggested, that they should strike due west and make for Sulaiyil and Mecca. And so, on February 22, they set out on what was to be a great adventure indeed. They had before them a trek of little less than 400 miles of generally rainless and now, as it proved, completely waterless desert. At the start his men, their spirits revived, no doubt by relief from the extreme tension which had prevailed during the last few days, seemed to regard the serious prospect before them with surprisingly light hearts, and Shaikh Abdullah was tempted to hope from this portent that the effort would be less penible than he had expected. At any rate they were all starting in good fettle, and for the first three days all went well. By the fourth day however it was clear that the camels were getting strained and overwrought, so much so that the abandonment of the enterprise began to be canvassed among the men; yet all the time they were persistently wasting the energies of themselves and their beasts by wandering off the track in search of oryx or gazelle—never with any success. They were by now five days out; they had had nothing but dates to eat since they started, they were getting sick of this and seemed to expect him to produce, like Moses, manna from the wilderness or water from the rock. After a stubborn tussle Shaikh Abdullah was finally obliged to consent to the whole party falling back to Naifa, where the caravan could be watered and the position reconsidered once more. The retreat commenced forthwith, and vigorous forced marching brought them to Naifa at midnight on the fourth day, mercifully without casualties.

Then when they felt completely at the end of their tether, succour reached them in a sudden change of weather. With a shower or two of rain their mercurial spirits rose again, and they showed themselves ready to face a final attempt to emerge westwards; but it was now wisely decided that the caravan must be split up, one party returning to Hasa with the spare baggage, while the rest, travelling very light, would make their way to Sulaiyil and thence to Mecca, according to the previous plan. So wonderful had been the effect of that providential burst of rain that there was now quite a brisk competition for membership of the Mecca party. Finally, the latter was made up to eleven and the two parties lost no time in sorting the baggage and preparing for the road.

Of the scene at parting Shaikh Abdullah writes graphically:

> Each of them saluted me with a kiss on the forehead.
> "Forgiveness for our failing," said Ali.

"There is nothing to forgive," I replied, "but I thank you for your services. In the keeping of God."

And so I parted from eight of the companions of two months in the wilderness. The farewell of the Arab is manly indeed. With fair words on his lips he strides off into the desert and is gone. He never looks back.

The Sulaiyil party, with numbers reduced to eleven men and fifteen camels, with twenty-four skins of water, and the Saluqi bitch, were now ready to set out on their final venture. The chances of success were not unpromising. Men and animals were thoroughly refreshed by their four days' rest at Naifa, and were now in fine condition. The clouds were gathering again above and a gentle drizzle was even blowing in their faces as they marched into the night. This time there could be no wandering from the track after elusive antelope; it was vital to husband their energies and press on while the favourable weather lasted. As in their start from Shanna, for the first three days there was a fair amount of grazing, and the loaded beasts were able to nibble as they went along. By the fifth night they had done 170 miles and had another 200, or slightly more, in front of them; meanwhile the weather was returning to normal and becoming more exhausting for man and beast. They were now from time to time possessed with doubts as to whether they were keeping the right course, but they pushed doggedly on, singing shanty songs to keep their spirits up. They were now as far from water in any direction as they could possibly be, and Philby likens his plight at this moment to that of Rohlfs in the Libyan Desert in 1874, and indeed the two were in many respects parallel. Anyhow they were now seven days out with more than half the distance behind them, so there could be no question of going back. In front of them lay a vast plain of gravel; there was no grazing and no fuel; they had marched nineteen hours and the camels were utterly exhausted; but now once again Alhamdulillah, the forces of nature, came to their rescue, the sky clouded over and the temperature cooled down. At last the journey was shaping to its end.

Suddenly there was a movement among some bushes away to their left, spectres, seven of them, moving along cautiously on a wide front. What could they be? A bevy of ladies, forsooth, come abroad to look for fuel and hailing from the outskirts of Sulaiyil, now only a few miles off. Greetings were soon exchanged, and even banter with the belle of the party. Camp was pitched near by, and on the morrow it was but an easy march to the heart of the settlement, which, alas, proved to have suffered terribly, since Philby's visit of 1918, from prolonged drought. As the camels wended their sinuous way through the cultivation, a slave emerged from the shade of a tamarisk tree by one of the wells to greet the travellers on behalf of Sulaiyil's Mayor. "Welcome to you," he exclaimed, "and again welcome. God give you life and strength." And so the journey was over; the waterless desert had been crossed. "Probably," writes the author, "for the first time in human history. 375 miles or more between water and water. Yet the camels drank sparingly. They were too thirsty!" A graphic finale to a great epic.

As in the case of his previous travels St.John Philby has not failed to make the best of his opportunities to record observations and collect specimens likely to be of interest to science, and much of the contents of the Appendices to the present volume will interest the general reader as well as the specialist. Thus, the lump of iron and specimens of slag found in what the traveller took to be volcanic craters at Wabar are understood to prove, on the contrary, that the pits in question are not volcanic but meteoric, and they have afforded material for interesting comparison with examples of similar phenomena in other parts of the world.

In the sphere of natural history, I have referred above to his collections of portions of egg-shells of an ancient as well as of the modern ostrich; and he has set at rest incidentally the doubt which prevailed in some quarters as to the names actually in use among Arabs of to-day for the white Arabian Oryx and the Marica Gazelle, or "Rim." He has recorded also detailed and careful observations in regard to the operation of that now familiar, if once mysterious, phenomenon, the "singing" or, as in this case, the "booming" sands of the Great Desert. And there is much else of scientific interest.

As to the accomplishment as a whole I have remarked earlier in this review that comparison with that of Bertram Thomas cannot be justly made, for it would be hardly possible to imagine two more fundamentally different conceptions formed for the achievement of the same end. It seems to me that their countrymen can do no more than congratulate both of them on their gallant achievements and offer warm tribute to the great but very different qualities which brought each of them triumphant success. P. Z. C.

AIR SURVEY BY MULTIPLE LENS CAMERAS

MULTIPLE LENS AERIAL CAMERAS IN MAPPING. By the TECHNICAL STAFF OF THE FAIRCHILD AERIAL CAMERA CORPORATION. *New York: Fairchild Aerial Camera Corporation* 1933. 9×6 *inches;* viii+162 *pages; illustrations and diagrams.* $5

THE principle feature of an air photograph is its ability to give a bird's-eye view of an area, and the characteristic of any eye-view is perspective. The perspective conditions of an air photograph are governed by the point of exposure, the orientation of the camera axis at the same moment, and the focal length of the lens. Now a map, at any rate in a small area, is an orthogonal projection of points in space upon a horizontal plane, and the only type of air photograph which gives immediately the equivalent of this projection is a vertical photograph of flat country. As very little country is absolutely flat, and since there is no known way of ensuring that a photograph is taken in an accurately vertical direction, a vast amount of study has been devoted to the problem of converting the perspective data of arbitrarily oriented photographs of any type of country to the conditions of a true plan. Instruments of extreme complexity, and representing the highest level of the instrument-maker's art, have been evolved and are in use. One of the factors however which tend to make their use uneconomic is the limitation of area covered by a single photograph due to the restricted angular field of a single lens. Owing to the speed of flight the aperture of a lens for an air camera can hardly be less than F/4·5, and the mount-eclipse even in the most advanced types becomes excessive at an obliquity of more than 35°. In other words the maximum ground length of the side of a square vertical picture cannot be greater than the altitude of flight.

To achieve freedom from this restriction, which reacts seriously on all forms of air survey, some form of multiple lens camera is necessary, and several attempts have been made. The most successful of the early attempts (and before the real urgency of the problem as described above) was that of Scheimpflug, in 1904, who mounted round a central camera seven similar ones directed obliquely. There are in this arrangement eight distinct cameras and eight pictures, and the relative perspective conditions of the eight are determined by calibration. The

general problem is however complicated, and this design has not been repeated. Another type was the 5-lens camera of the British Air Survey Committee (1923) in which the axes of the five lenses were parallel, and the rays to the four outer lenses were deflected outwards by means of mirrors. All five images were therefore photographed in the same plane and on the same plate. In Europe the experience of these original attempts has now crystallized into two examples: the Zeiss Vierfach Camera, and the Aschenbrenner 9-lens. In the Zeiss Camera, Scheimpflug's principle is adopted to join together four separate cameras inclining inwards. Its principle use is with the automatic plotting machine known as the Stereoplanigraph, in which the photographs can be held in a framework which is a dimensional replica of the camera complex. A further device however enables the four obliques to be rectified to the mean plane, and joined to form an equivalent composite vertical picture. The Aschenbrenner camera consists of a central objective surrounded by eight situated at the corners of an octagon and with parallel axes. Each ray system is deflected inwards by means of a double-reflecting prism, and the nine images are photographed on film in the same focal plane. A rectifying printer is arranged to produce from the nine negative images a single square positive equivalent to one having been taken by a very wide-angled single lens in the ordinary way. The angular field covered is 140° across the flats.

This latter development opens up a new possibility of the economic photography of large semi-civilized areas for the purpose of producing medium scale topographic maps, and a few notes on the fundamentals of such a camera will be pertinent. In the first place, for the most efficient application the final picture must be square, or nearly so. Secondly, owing to the photographic difficulties resulting from the obliquity of the outer rays, it has been found in practice that the maximum field that can be adequately covered is about 120°. With this datum, and taking the best covering power available for a single lens, the optimum arrangement is a seven-lens camera, with the axes of the six peripheral lenses deflected through 45°. In this design another and attractive feature is that the junction lines of contiguous pictures fall very nearly on equal-sized circles, and a perfect fit can be obtained by designing lenses with zero distortion at this particular obliquity. Thirdly, to keep the size of camera within easily handled limits the focal length of the lenses, and therefore the scale of the negatives, must be small; any required degree of enlargement can be imposed during rectification. Fourthly, only a single film should be necessary in order that the automatic electric operation may be simple. A camera embodying these factors and representing the most advanced design is now being constructed in Great Britain.

With these considerations in mind we may consider the volume entitled 'Multiple Lens Aerial Cameras in Mapping,' produced by the Technical Staff of the Fairchild Aerial Camera Corporation in America and kindly sent us for review. The Fairchild Corporation have in recent years evolved a variety of multi-lens cameras. The original design consisted of a central camera unit flanked by one set obliquely on either side, the final picture from the three lenses appearing in the shape of an hour-glass of which the longer axis was arranged to be transverse to the line of flight. Later a fourth unit was added which gave a further "tail" in the direction of flight. Finally, a fifth unit was added and the finished print appears as a Maltese cross. It is this 5-lens camera (T–3A) for which the greatest claims are made and which merits most attention.

It will be observed that the general principle is that originally adopted by Scheimpflug, but that none of the desirable principles outlined above is observed. On p. 23 it is admitted that a square picture is the ideal, but assuming that eight or nine lenses are required to cover it, it is stated that "the difficulty

of maintaining the exact angular relations between such a large number of lenses, the excessive size of such a camera if suitable focal lengths are used, and the problems involved in proper transformation and matching of the resulting photographs, make it impracticable to use a camera of this nature for general mapping purposes." In favour of the T–3A it is further stated that "a camera with five lenses, giving a photograph in the Maltese cross shape, incorporates all the necessary accuracy in compilation with a much reduced problem in accurate production of the composite print." On these points it may be remarked that since the Aschenbrenner camera is a success the difficulty of its construction and its impracticability cannot be excessive, whereas the claimed greater simplicity of the Maltese cross arrangement is due merely to the smaller number of joins between images and the consequent absence of tell-tale checks.

The description of the camera is somewhat inadequate. Although a short appendix is given on the "Aberrations of the Photographic Objective," no mention is made anywhere of the make or type of lens fitted, nor of the aperture at which it is used. Calibration, which is vital in multi-lens cameras, is very slightly described, and concerns itself not with the establishing of the orientation errors of the five camera units, but with the manipulation of the resulting pictures containing those errors.

The method of plotting used is the radial line method, known in England as the Arundel method and on the continent as Radialtriangulation. Here the disadvantage of not having a square picture is very clear, since the method relies for its accuracy on points situated well out in the corners of the print, *i.e.* in precisely those parts not covered by the Maltese cross. The advantage of the greater width of picture is thus more than counteracted by the acuteness of the angles caused by the short base lines, even assuming a zero calibration error.

Emphasis is laid on the necessity of accurate contouring, but no method is described of carrying it out. The use of a simple stereoscope is dismissed as being too inaccurate and suitable only for the roughest work. Experience elsewhere does not lead to this conclusion, though in this case the very short air base necessitated by the Maltese cross arrangement no doubt increases the difficulty considerably. Mention is made of the use of four- and five-lens cameras in conjunction with the Hugershoff Aerocartograph, a well-known automatic plotting machine. No description is given however of the method of adaptation used, which, in view of the originality and difficulty of the problem, is an omission much to be regretted. The discussion of contouring thus leaves us without any knowledge of how it is proposed to carry out this vitally important ingredient of a topographic map other than by the traditional ground methods.

In the chapter on economic considerations the use of the five-lens camera is compared with that of other multi-lens cameras, and in particular the Aschenbrenner nine-lens camera. It is stated that "a true comparison is on the basis of scale," *i.e.* a given scale of finished print is taken as a criterion, and the other factors of height of flight, width of strip, area covered by single picture, etc., referred to this. Since the focal length of the nine-lens camera is small (1·97 inches) and that of the five-lens camera three times as large (5·90 inches), although the angular fields are roughly similar, the width of a strip flown by the latter is thus shown as being over three times as large as that of the former, and the number of strip flights required reduced accordingly. The vital economic factor however is not the area covered at a given scale (since the scale can be changed within fairly wide limits by subsequent routine printing in a permanent enlarger), but the actual total angular field. The maximum angular field being about the same in the two cameras, the width of strip and reduction in flying costs are thus in reality similar in the two cases, whereas the area

covered by the square picture is considerably greater (about double) with a corresponding economy in the number of photographs required and the subsequent handling of them. It is therefore difficult to agree that the five-lens camera is more economical than others.

Air survey with multiple lens cameras is still in the experimental stage, and the arguments for and against any instrument or method deserve continual examination. The student will find much interesting material in the treatise under review, and will be grateful to the Fairchild Corporation for the opportunity of pondering the merits of the five-lens camera against the seven or the nine.

J. S. A. S.

REVIEWS

EUROPE

CREEKS AND HARBOURS OF THE SOLENT (including Spithead). By K. ADLARD COLES. *London: Edward Arnold & Co.* 1933. 10×7½ *inches; 96 pages; illustrations and charts.* 10*s* 6*d*

RIVERS AND CREEKS OF THE THAMES ESTUARY. By Lieut.-Commander JOHN IRVING. (The Yachtsman's Pilot. Volume I.) *London: Captain O. M. Watts* 1933. 10×7½ *inches; 100 pages; illustrations and charts.* 7*s* 6*d*

Mr. Coles's work will be found very valuable by those who do not know the Solent and also by those whose knowledge is limited to the better-known anchorages. Mr. Coles's method is to take the Solent ports roughly in west-to-east order from Keyhaven to Bembridge, and to give full directions for entering and bringing up in each of them. It is evident that he has taken the utmost pains to make the information complete and up to date, and to secure useful illustrations. He does not omit the tiniest creeks, such as Pylewell Lake and Titchfield Haven, which must be mere names, and perhaps not even that, to many who have been pottering about these waters for years.

As a specimen one may take his directions for Keyhaven. There is first a full-page chart on a scale of about 3 inches to the mile, which enables every boom and beacon to be marked and all necessary depths to be inserted. Inset in the text there is a really informative photograph of the leading marks over the bar, besides others of pictorial interest showing the scenery of the haven. The photographs are a feature of the book. The ordinary snapshot is generally much inferior to a sketch as a conveyer of information, but these are taken in picked weather with a long-focus lens and show the marks as they actually appear to the eye of the puzzled stranger who has no seconds to waste if he is not to get his boat aground. The letterpress gives the times of high water, range of tide, direction of adjacent streams, and depths on bar and within; full details of the best lines of approach and difficulties within the port; and information on moorings and anchorages, water supply and victualling, names of local watermen, and facilities for scrubbing and repairs.

The same careful method is followed for every port, large and small, on either shore of the Solent, accompanied by just the hints and warnings required by the small-boat sailor who would avoid mishaps and annoyances. When every boat's bookshelf carries a copy of this work there will be fewer excursions wrecked at the outset, and the approaches to Newtown River and the Hamble will be less frequently decorated with stranded vessels as the tide recedes.

Having given thanks for so much, the reviewer may perhaps be permitted to ask for more, in the subsequent editions which are certain to be called for. Geographically, the Solent does not include Langston and Chichester Harbours, and they are not described in this book. But it is safe to say that nine out of ten pleasure craft that cross Chichester bar are bound from or to the Solent, and economically (if that is the word) Chichester is as much a unit of that delightful playground as is Beaulieu. Directions for Chichester, whose difficulties are considerable, would usefully round off the book.

'The Yachtsman's Pilot' is a new edition of a work first published in 1927 and already widely used. The information, both in the text and in the plans and sketch-charts, has been brought up to date and is, generally speaking, the counterpart of that contained in the Solent volume reviewed above. The reviewer has recently found it very valuable in approaching for the first time many of the places dealt with. J. A. W.

THE COMPLETE SCOTLAND: a comprehensive survey, based on the principal motor, walking, railway and steamer routes. Historical Section. By J. D. MACKIE. Geology and Scenery. By T. M. FINLAY. *London: Ward, Lock and Co.* [1933]. 7×4½ *inches;* 448 *pages; plans and maps.* 7*s* 6*d*

TRAMPING IN SKYE. By B. H. HUMBLE. *Edinburgh: Grant and Murray* 1933. 7½×5 *inches;* xii+144 *pages; illustrations and sketch-maps.* 5*s*

SUN, CLOUD AND SNOW IN THE WESTERN HIGHLANDS, from Glencoe to Ardnamurchan, Mull and Arran. By ARTHUR GARDNER. *Edinburgh: Grant and Murray* 1933. 9×6 *inches;* 122 *pages; illustrations.* 12*s* 6*d*

The first of these books lives up to its description as a comprehensive survey based on the principal motor, walking, and steamer routes. It contains no less than thirty maps and plans, while there is also an historical sketch of the country by Professor J. D. Mackie, of Glasgow University, and a section on the geology and scenery by Dr. T. M. Finlay, of Edinburgh University. The authors have had the imagination to seize on those interesting details which link the present with the past, and there are plentiful allusions to figures prominent in Scottish history, ranging from St. Columba to Sir Walter Scott. Every town or village, large or small, is mentioned; "hikers" have not been neglected, and climbers in particular will find the descriptions of the ascents of such mountains as the Coolins of very real value. There is an excellent index.

'Tramping in Skye' is a practical book, well illustrated with photographs and maps, in which the author describes his own tour from Broadford to Sligachan and Portree, his tramp to Staffin, and his subsequent exploration of the coast as far as Dunvegan, ending up with the ascent of the Coolins. He gives some very sound advice as to the best way of hardening one's feet, tackling climbs, working out short cuts, and discovering likely looking cottages in which to spend the night. There is an index, and three appendices give the proper pronunciation of Gaelic names, details of train and steamer services, and notes on accommodation.

Mr. Gardner, whose book 'Sun, Cloud and Snow in the Western Highlands' is intended as a complementary volume to his 'Peaks, Lochs and Coasts of the Western Highlands,' writes, of course, from the point of view of the photographer. His book, which is also well indexed, contains no less than 116 photographs, many of them showing magnificent cloud effects. He explains with much practical detail exactly how these were obtained, and those who wish to follow him to Glencoe, Iona, or the hills of Arran should have no difficulty in tracing out the best route. B. M. N.

SLOVENE STUDIES: being studies carried out by members of the Le Play Society in the Alpine Valleys of Slovenia (Yugoslavia). Edited by L. DUDLEY STAMP. *London: The Le Play Society* 1933. 9½×7½ *inches;* 70 *pages; illustrations and sketch-maps.* 2*s* 6*d*

In August 1932 fifty members of the Le Play Society visited the Alpine valleys of Slovenia and, with local help, were able to carry out a considerable amount of regional study. The party was divided into two groups under the leadership respectively of Dr. Dudley Stamp and Mr. A. Davies with the co-operation of other specialists. The material collected by the parties was pooled and the results appear in this copiously illustrated pamphlet, written mainly by the two leaders with contributions by others. Thus Mr. H. J. Howard is responsible for a section on Vegetation which includes floral lists furnished by Captain C. Chase. Notes on maps and a brief bibliography complete a useful if necessarily somewhat sketchy study.

Most attention was devoted to the valley of the upper Savinje centring on the

village of Solčava, more familiar under its German name of Sulzbach. Till the building of a road along the river gorge in 1894 the area was peculiarly isolated, but that road made a certain amount of tourist traffic possible even before the war. Under present conditions this is developing, but the new boundary has ruined the trade in livestock and greatly increased the price of commodities not locally produced, while the timber industry, the most important local resource, has fallen on evil times. To those familiar with more westerly Alpine areas two points will appear strange. The one is the apparently reckless exploitation of the forests, which include beech as well as larch and spruce, the woods being cleared and burnt to extend cultivation and high pasture; and the other is the effect of the prevalence of massive limestones both in producing deep, sunless gorges and in limiting settlement owing to difficulties of water supply. Since comparatively little material is available in English regarding present conditions in Slovenia the pamphlet should be noted. The photographic and other material collected is available at the Le Play Society headquarters. M. I. N.

ASIA

CEYLON UNDER BRITISH RULE, 1795–1932: with an account of the East India Company's Embassies to Kandy, 1762–1795. By LENNOX A. MILLS. *London: Humphrey Milford* 1933. 9×5½ *inches;* vi+312 *pages; map.* 15*s*

From the footnotes and references that appear on almost every page of this book it is clear that wide research has gone to its making. Professor Mills remarks in his preface that no comprehensive account of the British régime in Ceylon has appeared since Tennent's work, published some seventy years ago, and apparently would convey the impression that a grave want thus arising has now at last been supplied. But the student will find, when he approaches the end of the book, that in the first twelve chapters, out of 250 pages, only some thirty are devoted to matters subsequent to 1860, and that owing, as the author says, to exigencies of space, the most recent and also most important period of the British connection is practically confined to a short chapter of twenty-one pages. There may therefore be some hesitation about accepting this work as the comprehensive disquisition on Ceylon as a British colony for which the world has been waiting, but that will not blind the student to its considerable historical value. A certain chronological disorder pervades the volume and makes it difficult of assimilation as a continuous narrative. To find its worth it should be treated as a series of lectures or essays on special phases of the subject, only loosely connected one with another.

In the first two chapters the earliest British lodgment on the island and the end of the Dutch connection therewith are considered. Chapters three, four, and five deal with the Dependency as an appanage of Madras under the Hon. East India Company, the appointment of the first Governor from England and his fight with the "Madras Click," the escape from the Indian connection and the early growing-pains of the community as a Crown Colony. Three separate essays follow: on the Civil Service from 1812 to 1885; on the Governor of Ceylon and his Council, down to about the end of the century; and on "Native Policy." There is a review in two chapters of the Kandyan wars and rebellions, followed by detailed accounts of the cinnamon and coffee industries in Ceylon during the nineteenth century. The thirteenth and last chapter consists of bald facts and bare statistics taken from recent Colonial Reports and Parliamentary Papers and set down without comment.

The word "conquest" is too much used. First, in the business with the Dutch,

called by the writer "The Conquest of Ceylon"; a solecism. Then, long years afterwards, in the taking of Kandy. As a matter of fact, the term, with its implications of military triumphs, is out of place in the history of the British in Ceylon, for, as the author himself shows, the ousting of the Dutch was effected almost without fighting, while, in the painfully protracted reduction of Kandy there was not much that redounded to the credit of British strategy or warlike prowess.

Errare est humanum might almost be the text of these lectures. Commanders throw away the lives of their men, soldiers desert their comrades, Governors tyrannize over their subordinates, officials ignore their duties and rob their charges. And yet, out of the seeming chaos we are shown emerging an administration strong of purpose and conscientious of motive, an organization of which Dr. Mills is pleased to say the Empire need not be ashamed. It is disappointing that the author has had to leave his subject after pursuing it but little more than halfway through its course. The march of events through the last forty years or so of steady material development; the burgeoning of the native mind under a rule now more than tinged with altruism; the consequent appearance of the sedition monger, the demagogue, and the agitator; lastly the transfer of power from the Governor to the professional politician: surely here is material enough for further delvings and subsequent reflections. It is to be hoped that neither exigencies of time nor of space will long prevent the continuation of this informative work to its proper conclusion.

The draft of a Governor's commission and instructions in 1872 appears as a lengthy appendix. There is an exhaustive bibliography of ten pages, a full and useful index, and a map sufficient for its purpose. W. A. G.

GENERAL CONCLUSIONS REGARDING THE INSECT FAUNA OF the Seychelles and Adjacent Islands. By HUGH SCOTT. (Transactions of the Linnean Society of London, vol. xix, part 3. Volume VIII of the reports of the Percy Sladen Trust Expedition to the Indian Ocean in 1905, under the leadership of J. Stanley Gardiner.) *London: Linnean Society* 1933. 12×10 *inches; 307–392 pages; illustrations and maps*

Dr. Hugh Scott presents a comprehensive review of the entire insect fauna of the archipelagoes and single islands of the Western Indian Ocean visited by the Percy Sladen Trust Expedition in 1905. These islands include the Seychelles, Chagos, and Amirantes groups, Coetivy, the Cargados group, the Farquhar group with Providence, Aldabra with its neighbours, Assumption, Astove, and Cosmoledo. Account has also been taken of the work of other expeditions; hence the review is based on a complete study of the fauna in so far as it is known at present.

The Seychelles have been regarded, not as true oceanic islands, but the remains of a much larger land which had possible connections both with India and Africa. Dr. Scott has tested this view by comparing their fauna with that of a purely oceanic archipelago. He selected the Hawaiian group for this comparison. His results show that while over 80 per cent. of the Hawaiian species are endemic, in the Seychelles about 65 per cent. are possible endemics; but this percentage will probably be reduced by a more thorough exploration of other countries. He concludes that the Seychellian fauna is the remains of that of an ancient continental or sub-continental land which has been isolated long enough to have a high percentage of endemic forms, but not so high as in a true oceanic archipelago. He further points out that there is but a slight degree of segregation of species in the separate islands of the Seychelles as compared with that in the Hawaiian group. The endemic fauna of the Seychelles appears to have developed through-

out the archipelago as a whole, a fact which suggests that its islands have been sundered from one another comparatively recently. The fauna also seems to have been stabilized long ago, with little or no continuation of the process of species formation down to recent times, such as has apparently taken place in the Hawaiian archipelago. Dr. Scott's conclusions regarding the stabilization of the fauna agree with those reached by botanists from a study of the plant collections. The principal change in both endemic fauna and flora in recent times has, he believes, been the extermination of many species.

There is a specially interesting section on the insects living between the leaf-bases of palms and screw-pines. Special note has been taken of the reduction of wings and eyes in island species. The Seychelles present a marked contrast to the Hawaiian islands, where there is a very large number of flightless species. But in neither group do the facts support the theory that flightless species have been specially produced in small islands owing to the danger that winged forms incur of being blown out to sea by winds. A feature of the fauna is the small size, inconspicuousness, and dull colouring of the species. There is a specially interesting zoogeographical discussion and a consideration of possible land connections between India and Africa in Mesozoic times. The author has dealt with the whole subject most exhaustively, and the geographer who is interested in land movements and distribution is likely to find much to assist his studies in this authoritative report. R. W. G. H.

PEAKS AND PLAINS OF CENTRAL ASIA. By Colonel R. C. F. Schomberg. *London: Martin Hopkinson* 1933. 9 × 5½ *inches; 288 pages; illustrations and map.* (*Colour photographs by Captain George Sherriff.*) 15*s*

Exploration and the hunting of big game have been the most usual lures which have drawn men to the heart of Central Asia. Colonel Schomberg was stimulated by neither of these impulses. He went out to "overwander Allah's earth," and he here describes what he saw and how he fared. Unencumbered by the unwieldy caravans of the scientific explorer, the antiquarian, or the collector of bird, beast, or flower, Colonel Schomberg travelled fast and far, and his account merits attention as a plain tale of a free-lance traveller on the plains and plateaux of Middle Asia between the Himalaya and the Altai. Those who would wander into a region which is still as England was in Tudor times, where the ladies still contentedly do their embroidery, and the gentlemen ride out with their falcons, should follow the author into those delectable regions which are still unharassed by telephones and gramophones, and where the motor car is scarcely known! Those who enjoy a personal narrative of travel in a region where travellers have been few should read this book, for they will get a pretty good idea of what the land—a vast and complex one—is like, and a better idea of its inhabitants—a curious, old-world, detached society, also a very complex one, and of their mode of life. For the sedentary population of Chinese Turkistan are, of all men, the *most* sedentary, the most easy-going, the most contented, and the most secure from outside influence, while their nomad neighbours, the Qirghiz, Qazaq, and Kalmuks are correspondingly mobile, unsettled, and unstable.

The land provides as many contrasts as its inhabitants, for it sinks to below the level of the ocean, and rises to summits of over 20,000 feet, and the author, who entered it by way of Hindustan, traversed it until he reached waters which flowed to the Arctic Ocean. In short, the reader is taken over the plains of Chinese Turkistan, touching at its principal oases from Kashgar to Hami; he visits the Tien Shan, where he will go over some little-known ground, and some quite new passes, for Colonel Schomberg is nothing if not original in his choice of a route. He will also continue northwards into that vague region called

Dzungaria, which is neither Turkistan, Siberia, nor Mongolia, but possesses the characteristics of each. Here he will meet the outposts of old Cathay and new Russia, and draw his own conclusions as to their respective futures. These chapters are of general interest, while Captain Sherriff's colour photographs are of high merit and very well reproduced. D. C.

AFRICA

THE GREAT PYRAMID, IN FACT AND IN THEORY. By WILLIAM KINGSLAND. Part I, Descriptive. *London: Rider & Co.* 1932. 10×7½ *inches;* xii+126 *pages; illustrations, plans, and sketch-map.* 30*s*

The literature of the Great Pyramid is not only vast but peculiar. It supplies in our days the safety-valve for the type of ingenuity that once indulged in circle-squaring, and the trisection of the angle. Mr. Kingsland's object in the present work is to give "the general reader a fair and clear understanding of that stupendous monument of Ancient Knowledge and Enterprise . . . and of the various theories that have been put forward in connexion with it." But it must be doubted whether he has succeeded in his laudable object. A keener critical sense is required to sift the wheat from the chaff in this very mixed harvest—he quotes seriously an American quadrature published in the fifties—and at times he shows a carelessness in the figures which leads him into the very errors he so rightly deprecates in the case of Messrs. Morton-Edgar and Davidson.

As an example of the latter, take his treatment of the lengths and angles of slope of the interior passages. On p. 49 he gives these angles in tabular form as observed by Petrie and Piazzi Smyth and assumed for "theoretical" purposes by Morton-Edgar and Davidson. Now two out of four of Petrie's figures are incorrectly copied from his 'Pyramids and Temples'; and moreover the figures for the entrance passage are not comparable, Petrie's figure referring to the mean axis of the whole and Smyth's to that of the built part only. This difference is ignored by Mr. Kingsland, though it amounts, according to Petrie, whose observations at this point have a probable error of about 10″ of angle, to as much as 2′ in azimuth and about 5′ in altitude. (Smyth never even penetrated the rock-hewn portion of the passage.)

Again, in computing the position of the lower end of the entrance passage in level below and distance south of the original doorway, the only measured data we have are the angle of the passage and its length (which latter should be multiplied first by the sine and then by the cosine of the angle to give the required figures). Mr. Kingsland however considers the various estimates that have been made of the horizontal distance and notes that one of them differs very slightly from a length of 180½ cubits (taking his own somewhat low value for the cubit). He has therefore "no hesitation in adopting this figure" (p. 52); and, by solving the resultant right-angled triangle of which two sides are given, he arrives at an angle of slope 17′ 46″ less than Petrie's observed angle. This is somewhat unfortunate, as the whole of his reconstruction of the internal dimensions of the Pyramid hinges on this figure.

Mr. Kingsland might also have made more use of the published results of modern Egyptological research, notably Somers Clarke and Engelbach's 'Ancient Egyptian Masonry'; and Professor Peet's edition of the 'Rhind Mathematical Papyrus.' Though this papyrus is a middle kingdom document, its mathematical methods, owing to the well-known Egyptian love of tradition, probably differed but slightly from those of the Pyramid Period. It affords an obvious explanation (without any necessity of involving π) for the original

dimension of the Pyramid being 280 cubits high by 440 cubits square on the base. The Ancient Egyptians expressed the slopes or batters of Pyramids as so many palms and digits (per cubit of height understood). And, as the cubit was divided into 7 palms of 4 digits each, the above dimensions imply a batter of the round figure of 5 palms 2 digits. This explanation is rendered more probable by the fact (also shown in the Rhind Papyrus) that the Egyptian did not use the Archimedes value of 22/7 for π, but obtained the area of a circle by squaring 8/9 of its diameter.

In the purely descriptive part of the work Mr. Kingsland is clear and lucid, and illustrates his descriptions by a series of good half-tone and line blocks after photographs and drawings. The book is well produced. C. A. E.

HANDBUCH DER KLIMATOLOGIE IN FÜNF BÄNDEN. Edited by W. KÖPPEN and P. GEIGER. Bond V, Teil X. The Climate of Rhodesia, Nyasaland, and Mozambique Colony. By C. L. ROBERTSON and N. P. SELLICK. *Berlin: Borntraeger* 1933. 10½ × 7 *inches;* 19 *pages; diagrams and sketch-maps*

This small instalment of an extensive work contains useful meteorological tables for twenty-six stations in the territories named. On the explanatory side however it is not quite up to the standard of some of the earlier Parts, and the absence of a physical relief map will make it more difficult for the student to relate the climate to the geographical background. One misses any descriptive passages, embodying local colour, which are always desirable in a work on climate to supplement and set off the necessarily very circumscribed information conveyed by dull statistics.

An anomaly which is pointed out, though not accounted for, is the prevalence of westerly winds at 6000 feet on Mount Nuza, Southern Rhodesia, apparently in opposition to the pressure distribution. The comparative rarity of destructive hailstorms in a region which adjoins the hail-stricken Union of South Africa seems strange, but the contrast is not commented upon. Snow was recorded once during a period of some twenty years, but at no place was the ground cool enough to permit it to lie. It would have been interesting to be told something of the geographical distribution of the phenomenon in this hot area, as also of the accompanying meteorological conditions. L. C. W. B.

AMONG CONGO PIGMIES. By PAUL SCHEBESTA. Translated from the German by GERALD GRIFFIN. *London: Hutchinson & Co.* 1933. 9½ × 6 *inches;* 288 *pages; illustrations and sketch-maps.* 18*s*

The German original of this work, "Bambuti: die Zwerge vom Kongo," was reviewed in this *Journal* for February 1933 (p. 177), so that it is necessary only to note here the appearance of an English version. The translation, which keeps fairly close to the original, is not particularly distinguished, but it will doubtless be welcomed by anthropologists interested in Dr. Schebesta's researches among the Central African pygmies of the Ituri. The book has all the photographs of the original. G. R. C.

UNDER SEVEN CONGO KINGS. By R. H. CARSON GRAHAM. *London: The Carey Press* [1933]. 8½ × 5 *inches;* xii + 294 *pages; illustrations and sketch-map.* 6*s*

This book is a history of the Baptist Mission which has been at work at San Salvador, Angola, since 1879. The author writes with intimate knowledge, since he worked there from 1886 to 1923. This area is the remnant of the old native kingdom of the Congo, which entered into relations with the Portuguese at the end of the fifteenth century, and received Catholic missionaries. It ultimately

passed under Portuguese suzerainty in 1884, during the reign of the first of the kings referred to in the title, Dom Pedro V. Elelo. During its history the mission has passed through troubled times, yet it has erected buildings, maintained a hospital and dispensary, and can claim a membership of over fifteen hundred. Though necessarily presenting his own point of view, Mr. Graham writes very fairly and with sincerity, and illuminates the difficulties attending missionary enterprise in Central Africa. G. R. C.

NORTH AMERICA

NEW ENGLAND'S PROSPECT: 1933. American Geographical Society. Special Publication No. 16. Edited by JOHN K. WRIGHT. *New York* 1933. 10×6½ *inches;* viii+502 *pages; diagrams and maps.* $5

The title of this volume is borrowed from one by William Wood, published in London in 1634. Three hundred years ago it was deemed necessary to publish an impartial account of New England to counteract false statements "heretofore past the Presse" or made by enemies of the new colony. What was necessary then is even more necessary to-day: never has it been more desirable to have a careful, unbiased stocktaking of the resources of the whole world, of their present utilization, and of the reserves for the future. In 'New England's Prospect, 1933,' the stocktaking has been undertaken by twenty-seven authors, each an expert in a selected field. The first five papers are introductory; the remainder deal with specific problems. Before he reaches the editor's concluding chapter on the "changing geography of New England" the reader will feel much as a statesman must feel when, surrounded by the reports of his experts, he is still faced with the task of framing a far-reaching and lasting policy. For each contribution of necessity tends to emphasize the viewpoint of its author, and some of the conclusions are surprisingly contradictory. Great companies, says Mr. E. A. Filene—himself a leading business man—(p. 69), "have done away with opinions and spend millions to know facts. The same study in New England will disclose the seat of our troubles." Yet in the next sentence he says, "particularly we must find out what New England is best equipped to make by mass production and market by mass distribution." The reader turns back to pp. 12–13 only to find the statement that "in a world constantly growing richer and more and more flooded with low-grade, standardized goods, the demand for quality and beauty may also grow. Better than any other section, New England would be able to meet that demand." It is clear therefore that although the reader has been provided with an immense amount of carefully arranged and well-documented information, he is still free to exercise his own judgment and form his own conclusions. He will be particularly grateful to Dr. J. T. Adams for a masterly summary of the historical background which forms the opening section. For the remarkable isolation of New England needs to be fully recognized. From the arrival at Boston of two thousand well-equipped settlers in 1630, the population increased rapidly by immigration and native births to eighteen thousand in 1640. Then for two whole centuries immigration abruptly ceased. New England developed along unique lines. New settlements were founded, not by individuals, but by small communities grouped around a new church. Each community lived as a tightly knit group, church affairs and civil affairs were scarcely separable, Puritanism became wedded with a unique local conservatism. The founding of Harvard in 1636 narrowed the outlook, for it meant that the intellectural leaders were trained locally instead of benefiting by contact with a broader civilization at Oxford or Cambridge. The growth of New

York and the improvement of communications (as by the Erie Canal in 1825) between New York and the interior served only to accentuate the isolation of New England. It was about 1830 that the Industrial Revolution produced a change, but the individualism of New England has remained. Its present-day problems are not, of necessity, those of the remainder of the United States—rather are they those of Old England.

The editor, Dr. J. K. Wright, has contributed a general study of the geographical setting: the variety of scenery and of associated geographical environments heightens the comparison with Britain. The next three sections—Industrial Prospects, Unemployment, and a statistical study—are economic in character but particularly interesting because of their authorship. The first is by an academic economist, Dr. Artman; the second by a business man; the third by a statistician.

This pooling of knowledge for the common good and a similar variety of outlook are characteristic of the specialist sections which follow. Food supply, agricultural production (an extensive and valuable section by Prof. I. G. Davis), agricultural marketing, forestry and forest economics, fisheries, power and power resources, manufacturing, communications, trade, sociology, social service, regional planning, and local government are all subjects brought under review. It might be thought that such a collection could have no uniting principle, no common interest. Such is not the case, and therein lies the world-wide importance of this book. For if the modern scientific geographer has an important role to fill, it is that of a co-ordinator of viewpoints which have for too long remained wide apart. His work is truly that of a nation-planner, and so of a nation builder. From this angle the present book is worthy of the attention of all geographers; its value is further enhanced from the inclusion of examples of two important geographical methods. One is Dr. Whittlesey's detailed study of two typical localities (one a coastland, one an interior mountain valley) exemplifying the regional survey method; the other is a brief note on the comprehensive survey of rural Vermont, exemplifying a co-operative study of a large area. L. D. S.

CENTRAL AND SOUTH AMERICA

EIGHT REPUBLICS IN SEARCH OF A FUTURE: evolution and revolution in South America. By ROSITA FORBES. *London: Cassell and Co.* 1933. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xii + 340 *pages; map.* 8*s* 6*d*

IMPRESSIONS OF SOUTH AMERICA. By ANDRÉ SIEGFRIED. Translated by H. H. and D. HEMMING. *London: J. Cape* 1933. $8 \times 5\frac{1}{2}$ *inches;* 128 *pages;* 5*s*

The eight republics described by Rosita Forbes—Brazil, Uruguay, Paraguay, Argentina, Bolivia, Peru, Chile, and Ecuador—make up the whole of South America except the part north of the equator comprising Colombia and Venezuela and the three Guiana Colonies. Her account, based on a year's visit, is a valuable one for the reader who has neither visited nor studied the countries it describes. It contains in language that is often brilliantly picturesque information generally sought from text-books. The positions of the countries and their natural divisions are set forth—Argentina, stretching between the Tropic and the Antarctic; Chile "a 2000-mile strip cramped between the Andes and the Pacific"; and Bolivia, Peru, and Ecuador, each with its high, middle, and low zones. We are told the natural products, the agricultural development, and the mineral wealth of each country or extensive district. We see vast herds of steers passing leisurely from the centre of the continent through the fattening lands to

the American killing plant near the coasts, sheep in the cold rough lands of Patagonia and southern Chile, llamas in Peru, grain in south and sugar in north Argentina, and sugar also in some of the other Republics, cocoa plantations in Ecuador, and coffee in Bolivia. We read of the nitrate camps of Chile scattered amidst glittering black shingle and the largest copper mine in the world which is near to them, as well as of the mountains of silver and the ranges of tin in Bolivia and the mineral mountains that yielded treasure to the conquerors of Peru. The towns are pictured for us sometimes in great detail, sometimes in a few incisive words. We find the description of Buenos Aires somewhat bewildering, but Rio stands out clearly set in green forests with mountain background. Montevideo is "a delightful city surrounded by ivory beaches and the spear-blue of eucalyptus woods". Asuncion, the capital of Paraguay, is "a gentle little city mellowed by Jesuit heritage." Lima in Peru once dominated Spanish America, and Quito in Ecuador, a little old town of cobbled streets and white tiled houses, "has every grace and no pretentiousness." The proportions of the populations of the several republics constituted by the different races—Portuguese, Spanish, Indians of various tribes, negroes and mixtures of all these—are set forth, as well as the extent and nature of more recent colonization. The development work that has been done by the British is not overlooked nor the reasons why they are not now in the forefront of colonization. The author dwells on the elements making for future trouble, whether derived from Moscow or from the conditions of the Indian population in the countries where they are numerically dominant and yet powerless to improve the miserable condition of their lives.

The foregoing note of a few of the leading features of Rosita Forbes's book leaves unmentioned the vividly told incidents of her travels and many brilliant descriptions which will make the reader realize, almost as if by personal experience, the scenes she passed through and the people she got to know. When so much pleasure will be derived by so many from her book it seems ungracious to mention the suspicion that sometimes the colour of an incident may have been heightened in the telling of it and that sometimes a more direct connection of the writer with it than that which actually existed may be suggested. Sometimes also the parallels and contrasts that decorate so profusely her pages seem rather to confuse than to illustrate. To these minor faults may be added that of a map not specially suited for elucidating the text.

Rosita Forbes deals with the revolutionary idea in a preliminary chapter which puts down as the centres of disaffection the army officers representing the bourgeoisie, the University which is the megaphone of the intellectuals, and the workers in the factories and docks of the eastern ports who voice industrial communism. Revolutions and the politics that lead up to them figure more largely in the slight work which has been compiled from Professor André Siegfried's diary letters written during a visit lasting rather more than three months to Peru, Chile, Argentina, and Brazil. He brings out the prominent part played in all the Republics by the Presidents whose executive power, though nominally subject to limitations similar to those in the United States Constitution, in actual practice knows no counterbalancing influence; it lasts as long as it is supported by the army and the police and as long as sufficient money can be gathered by taxation to make sure of the interested devotion of partisans. He suggests, as does Rosita Forbes, that revolutions in the predominantly Aryan States may be of less gravity than those in the Andean Republics, where the social problem of rich and poor may become complicated by the racial one of white and coloured. Professor Siegfried's sections on the economic conditions of Chile, Argentina, and the Republics generally are clear and convincing. His descriptions of towns and country are sometimes more

precise, but generally less vivid than those in Rosita Forbes's work. His parallels, like hers, are not always helpful. The map at the beginning of his book serves its purpose. The chapter of general impressions at the end is excellent. M. N.

AUSTRALASIA AND PACIFIC

LES POSSESSIONS FRANÇAISES DU PACIFIQUE. By S. FERDINAND-LOP. (Collection France d'Outre Mer. Edited by GEORGES HARDY.) *Paris: Larose* 1933. 9×5½ *inches;* 148 *pages; sketch-maps.* 15 *fr*

This book is divided into three parts, dealing in succession with New Caledonia, the New Hebrides, and the French Establishments in Oceania. The purpose seems to be to give an outline of useful information relative to the economic geography of these places in the simplest possible form; the leading facts concerning each dependency are set out under identical headings, so that any particular point can be found at once by reference to the index. The plan has one advantage: space is economized and arrangement simplified when bare facts and figures are allowed, however monotonously, to speak for themselves. On the other hand, the absence of geographical description and the omission of anything that is not of a severely practical or reference-book nature make it difficult for the reader to form any clear pictures of these scattered French islands. To this end the maps supplied are of little assistance; that of the most important island, New Caledonia, for example, is on too small a scale, is of the bare outline type, and gives only a selection of the names of places mentioned in the text.

It is clear from the accounts given that the French Pacific Islands are making slow economic progress, due partly to the shortage of labour which has been unsatisfactorily met by the importation of Javanese and other Asiatic coolies, partly to their remoteness, especially from "la Métropole" (France), and the consequent high transportation costs on produce, and partly to the slow increase in the numbers of the French settlers even in the islands suited climatically to Europeans. E. W. S.

ECONOMIC AND HISTORICAL GEOGRAPHY

SELECT DOCUMENTS ILLUSTRATING THE FOUR VOYAGES OF COLUMBUS. Translated and edited by CECIL JANE. Vol. II. The Third and Fourth Voyages. With a supplementary introduction by E. G. R. TAYLOR. Works issued by the Hakluyt Society. Second Series. No. LXX. *London: Hakluyt Society* 1933. 9×5½ *inches;* xc+164 *pages; maps and facsimile MS.*

The documents selected are, for the third voyage, the Letter of Columbus to the Spanish Sovereigns, and his Letter to Juana de la Torre; and for the fourth voyage, the Letter to the Sovereigns, and the Relation of Diego Mendez. The Spanish texts and English translations are printed on opposite pages, an arrangement more sightly and convenient for comparison than the alternative method of giving one version above the other on the same page.

These documents will be familiar to serious students, who will find that in the present edition they are enriched with ample explanatory footnotes. To other readers, who may know their Columbus only at second hand through the accounts of some of the rather temperamental historians who have been attracted to write on him, the Letters should prove extremely interesting, for they provide a self-revelation needing little additional comment. They explain the apparently ungenerous behaviour of the Spanish authorities, for they show their author to have been a visionary, unfit to exercise the administrative powers conferred on

him by his chartered rights. An agreement can hardly bind one party when the other is of unbalanced mind, and that is the condition towards which the unhappy author of these letters was degenerating, however capable he may have been at the opening of his public career. In the closing stages he was but the wreck of a great man, physically afflicted by hardship, worrying and brooding over misfortune, prone to exaggeration, constructing fantastic hypotheses upon a blend of fact and self-deception, and yet clinging to his belief in the Almighty, who was but chastening him to render him a more perfect instrument, and convinced always that he was on the brink of the discovery which would lead him to the Asia of his dreams. It is a sad spectacle, saved only by the faith of the mystic from being a degrading one: "Our Lord miraculously consoled me and said, 'Take courage, be not dismayed nor fear; I will provide for all; the seven years, the term of gold, are not passed, and in this and in the rest I will give thee redress.' "

The untimely death of Mr. Cecil Jane prevented the completion of the Introduction he had planned for this volume. What he had accomplished is printed here, written in the painstaking style of his commentaries on the earlier voyages; but it includes only seven of the twenty-one sections whose titles he had noted for treatment. It is a great pity that the work was unfinished, for Mr. Jane held sober and well-informed views on his subject, which cannot now be examined as they deserve. The Hakluyt Society has been fortunate in securing help from two of its members: Professor E. G. R. Taylor contributes a convincing explanation of the geographical ideas of the period, which will save many from error, and also some prefatory "Notes on the Documents"; and Mr. Edward Lynam has arranged the book and seen it through the press. J. A. W.

GENERAL

THE POETRY OF GEOLOGY. By KENNETH KNIGHT HALLOWES. *London: Thomas Murby & Co.* 1933. $7\frac{1}{2} \times 4\frac{1}{2}$ *inches;* xii + 62 *pages;* 6*s*

The combination of geology and verse recalls Bret Harte's famous "chunk of old red sandstone." Some of Mr. Hallowes's lines are not unworthy to be classed with poems in that vein, as, for example:

> "A Monster of the Pliocene,
> Whose roars had been for aeons dumb—
> Gigantic bones that once had been
> A living Sivatherium!"

highly reminiscent of Mr. Belloc's Dodo. The author's autobiographical preface shows that he has no misgivings, and "sends forth these children of his brain to become, he hopes, helpful inmates of the household of man." But he produces lines like these:

> "The Old Alluvium, dark grey,
> In section where the water flows,
> Formed of lime-nodules, and of clay,
> A wavy lamination shows—"

or

> "Beneath this field of graves in deep ravine
> A bed of fossil ichthyolites is seen
> Entombed in Old Red Sandstone strata built
> In hollow of the hills by river-silt—"

His *In Memoriam* lines will repay perusal. In his introduction he insists that the Poet of Science should undergo a thorough practical scientific training; but it is also advisable that he should be a poet. J. H. R.

THE MONTHLY RECORD

INTERNATIONAL GEOGRAPHICAL UNION, WARSAW, 1934

A General Assembly of the Union, and an International Geographical Congress, will be held in Warsaw at the end of August 1934. The first circular of the Executive Committee, signed by Professor Eugenjusz Romer as Chairman, and Mr. Stanislaw Pawlowski as General Secretary, invites those who intend to participate in the Congress and in the excursions before or after to inform the Secretariat of the Congress as soon as possible, at the High School of Commerce, 6 Rakowiecka Str., Warsaw, Poland. All persons engaged in the field of geography as well as those interested in geographical research are entitled to admission as members of the Congress, on registration by the Secretariat and payment of the fee of 40 zlotys, of which at par 43.38 go to the pound, but at the present rate of exchange about 28.

The relationship of the Congress to the Union is discussed in our account of the Paris Congress of 1931 (*Journal*, vol. 78, p. 544, December 1931). Attendance at the Assembly of the Union is limited to delegates appointed by the National Committees, but membership of the Congress is open wide. Following the fashion set at Paris the Secretariat proposes a list of Themes which may be discussed in the six sections. There are to be three long excursions before the Congress, and four after it, under the guidance of Polish geographers.

British geographers who propose to attend the Congress are asked to apply early for the form of registration and the programme of excursions. After the end of January 1934 participation in the excursions cannot be guaranteed, as the numbers in each are limited. The cost will be about 40 zlotys per day.

TWO AMERICAN ANTARCTIC EXPEDITIONS

After several years of comparatively little activity in the Antarctic in exploration on land, this coming season will witness the attempts of two expeditions, both from the United States, to discover the nature of the unknown interior of the Antarctic continent, and in particular whether there is an ice-covered strait connecting the Ross with the Weddell Sea. It will be recalled that the solution of this problem was the chief aim of the expedition projected early in 1932 by the late Mr. H. G. Watkins, the plans for which had to be abandoned owing to lack of financial support. The two expeditions, led by Mr. Lincoln Ellsworth and Rear-Admiral Byrd respectively, are now both on their way south. They are very different in size and scope.

The Ellsworth Expedition, which left Norway at the beginning of August, has a personnel of fifteen, and includes Sir Hubert Wilkins, who has signed on as meteorologist and reporter. The expedition hopes to reach the Bay of Whales some time during the latter part of December, depending on ice conditions, and the ship, M/V *Fanefjord*, bought in Norway at the beginning of the year, and renamed *Wyatt Earp*, will be used as a base. Mr. Lincoln Ellsworth, leader, navigator, and photographer, and Mr. Bernt Balchen, who was Rear-Admiral Byrd's chief pilot on his Atlantic and South Pole flights, will then make the Transantarctic flight, which is the sole object of the expedition. The party will make for the Filchner Barrier, setting a course which will take them about 400 miles from the South Pole. The double journey of 2900 miles is expected to take twenty hours, unless bad weather should force the party to land and await better conditions. On arrival at the Weddell Sea no landing will be attempted, but the party will return at once to the base. If all goes well the expedition will not remain more than a week in the Ross Sea, though sufficient

supplies have been taken to enable the party to winter in case of necessity. A Northrop low-wing monoplane has been specially built for this flight, and has undergone extensive tests both in Canada and Norway; the special photographic equipment includes a camera operated by a clock which will record a continuous strip, 1 1/2 miles wide, of the route traversed, when flying at 3000 feet, photographs being taken every ten seconds. Two Zeiss cameras for oblique and vertical photographs have also been taken. The party propose to keep in touch with the ship by means of a special aeroplane transmitter and receiver, with generator driven by the engine.

The other expedition, Rear-Admiral Byrd's second venture in the Antarctic, is planned on a much larger scale, the intention being to winter at "Little America." Two ships have been chartered: the cutter *Bear*, built at Greenock in 1874, and famous as one of the Greely relief ships, has been acquired from the U.S. Coast Guard Service, and the S.S. *Pacific Fir* is being taken as a supply ship to obviate the necessity of a return voyage to New Zealand for stores. A biplane and an autogyro are being taken, as well as spare parts for the two aeroplanes left behind by the expedition in 1930, which it is hoped may still be fit for use. Besides this, the party will have with them complete sledging equipment, and 150 Labrador dogs.

Rear-Admiral Byrd has planned a full programme, which includes a repetition of his flight over the Pole, and, if possible, another flight towards the Weddell Sea, with a view to extending any discoveries made by the Ellsworth Expedition. An aerial survey of the land round the Magnetic Pole is also planned, and other flights will be over Marie Byrd Land, discovered by Rear-Admiral Byrd on his first expedition. It is stated however that the chief work of this year's expedition will be the investigation of the lands already discovered from the air, with special reference to the mineral deposits of these areas. The scientific programme includes auroral, biological, cosmic ray, geophysical, medical, meteorological, oceanographical, and magnetic observations, and determinations of gravity. Extensive geological work is planned, and the glaciologists of the party intend to make a series of investigations on the Great Ice Barrier. An unusual feature is the inclusion of meteor observations in the programme. Special attention will be given to the weather observations, and it is hoped that a meteorological station may be established somewhere near the Pole.

The expedition, with a personnel of seventy, including several members of the first Byrd Expedition, is expected to reach Little America, the base set up by Rear-Admiral Byrd in 1928, by the end of December, when, having landed the party, the two ships will return. The expedition will remain in the Antarctic until the open season of 1934–35; but will be in communication with the outside world by short-wave wireless. F. D.

The departure of Admiral Byrd was celebrated in the United States on the evening of Sunday October 15 by a Farewell Broadcast, to which Admiral Sir William Goodenough, as President of our Society, contributed the following message over the Transatlantic telephone:

"As a brother officer of Admiral Byrd and on behalf of the Royal Geographical Society I send a message of most sincere good wishes for success to the Admiral in his new expedition to the Antarctic. We regard this expedition as a scientific one of the first importance. No one is more fitted to lead it than Admiral Byrd. Original thought, power of organization and execution, experience at sea, on land, and in the air, combine to make him a master of Polar exploration and a figure of world-wide reputation, and added to that is a modesty that induces affection as well as respect among all who know him or know of him.

"What is it that takes men to the Polar regions? First it is the fascination of the unknown over the mind of man and his desire for knowledge. Read the old Norwegian Saga 'The King's Mirror,' and of the three things that make men return again and again to the cold hardships of those inhospitable places. Read Nansen's wonderful description of the beauties of a Polar night. Woven into this is the hope that discoveries may prove of use to mankind in the future.

"The Antarctic continent is a forbidding one, but if man is to be true to his being he must press forward till every place has been trodden under foot. It is the privilege of man that it is given to him alone to make these researches, and Admiral Byrd is among those who realize this.

"What is it that we want to know? Is the great Antarctic continent one piece of land or two connected by some great bridge of ice? What minerals does it contain? Is it within the power of man to produce them? How far will meteorological investigation help us to forecast the weather conditions? These and many other problems are those that Admiral Byrd and his companions will assist to solve. My dear Admiral, I don't know if you are listening. I hope you are. It's half-past one in the morning here, and all good Admirals should be in bed. You will soon be turning in yourself. Sleep well in the knowledge that a host of people wish you well, and none more so than the Royal Geographical Society."

RESEARCH MEDAL FOR MR. HEAWOOD

We have the pleasure to record that the Council of the Royal Scottish Geographical Society has awarded its Research Medal for 1933 to Mr. Edward Heawood, Librarian of our Society, "in recognition of his scholarly researches upon geographical discovery and early cartography as well as for his long unremitting and generous help to other researchers while carrying out his duties as Librarian."

THE SURVEY OF THE LABRADOR COAST

We are obliged to Vice-Admiral Sir Percy Douglas for permission to print the following extracts from a letter of Captain A. G. N. Wyatt, R.N., in command of H.M.S. *Challenger*.

At Sea: 27 September 1933.

We left Halifax on July 18 and arrived at Hopedale on the 23rd, carrying out running surveys to correct the chart on our way; we encountered no ice other than bergs, and I learnt that the last of the pack-ice was seen off Cape Harrison on July 4, while in the Nain district there had been no pack-ice on the coast at all this year since the landfast ice went out in June. We had an uneventful passage north, and since our arrival have been mainly employed on the passage from Nain to seaward to secure a safe exit for the ship in the dark and stormy days of November, and have completed some 30 miles of track with the adjacent bays and islands; but now that the weather outside has got too stormy we are continuing the inner run southward from Nain. We have had, on the whole, very good weather until the past fortnight, but more strong winds than last year, and in the last fortnight two bad gales, one from east and the other from north, with winds of force 10 which kicked up a heavy sea on the coast so that patches with as much as 7 fathoms over them were inclined to break, which afforded me a good opportunity of spotting new dangers after the gale was over and before the swell had run down.

All our arrangements for the Winter Survey are now made, and Baker, Deane, and Bingham the doctor, will form the party with five ratings; they will live in the disused Hudson's Bay Company's hospital at Nain, a most excellent building, working from there by sledging camps for a week or two at a time; we have managed to collect a good team of a dozen dogs, seven of which had to be pur-

chased while five have been lent for the sake of their keep; the doctor has also bought six of his own. We have arranged for the services of a settler and his team, and later, when the ice has gone in the spring, he will substitute his motor boat for the dog team, so I hope they will be able to do useful work most of the time, and I am sure will have a most interesting winter; I envy them very much indeed. I have now discontinued the work with the ship and am on my way to Halifax for oil and provisions, and I shall then be able to stay on the ground until the end of the season and sail direct for the United Kingdom, having only had to oil three times during the entire absence from home. I have left a party with the two boats very snugly camped in a land-locked harbour a mile or two south of Nain to get on with the inner track; it is an excellent spot with plenty of wood and water, and only about an hour's walk across the hills from Nain. It would be an ideal place to winter a ship as the holding-ground is mud; it is small and land-locked and there is a bottleneck which would prevent any possibility of the ice going out in a body. Our echo-sounding gear, both deep and shallow types, have been in constant use and given excellent service, and the former has given perfect records at 4000 fathoms. There have been no low temperatures so far, but the hills are all now sprinkled with snow and we have just had the thermometer down to freezing on board once or twice, but there have been 10° of frost ashore. The country is now looking very fine, as large areas are covered with creeping berry plants which turn scarlet at this time of the year, while the dwarf birch shows as dark orange masses. If conditions are no worse than I have been informed I expect to be able to remain on the coast until November 15, which is as long as my orders permit.

CHANGES OF LEVEL ON THE NORTH SEA COAST

Interest in the question of the sinking of the North Sea marshes between Esbjerg and the Zuider Zee has been aroused by further finds of remains below sea-level and by earth shocks in the Lower Rhine valley. Dr. G. Wegemann has collected and summarized the evidence for an increase in the difference between the level of the marshes and mean high water in *Petermanns Mitteilungen* (7/8, 1933). The determination of the change is complicated by shrinkage and compression of the marshes, which vary locally, and by increase of mean high water, in addition to geotectonic subsidence. The evidence reviewed includes peat moors with remains of trees discovered below sea-level, the extreme figure for which is 20–22 metres; Roman remains in Katwijk and Domburg some kilometres from the present coast-line and 1·5 metres below the sea: early Neolithic remains near Husum at a depth of 6 metres; the field-furrows of the predecessor of Husum, destroyed in 1362, now 2 metres below; comparison of the level of dyked enclosures with their surroundings; and precise measurements, which show that public buildings in Bremerhaven, over a varying period of years, have sunk 2 mm., 3·9 mm., and 1·6 mm. per annum. Dr. Wegemann's conclusions show that only about 7 per cent. of the sinking can be attributed to geotectonic causes. Uncertainty as to the age of the various instances considered makes a definite result unobtainable, but allowing for this, he calculates that of the annual sinking 5 mm. is to be attributed to shrinkage, etc., 2·5 mm. to increase in mean high water, and 0·6 mm. to geotectonic surface changes. The difference is greater towards the south and west.

INTERNATIONAL CONGRESS OF ANTHROPOLOGICAL AND ETHNOLOGICAL SCIENCES

The first session of the International Congress of Anthropological and Ethnological Sciences will be held in London from 30 July to 4 August 1934. This Congress is designed to include all those departments of research which con-

tribute to the scientific study of man, in their application to races, peoples, and mode of life.

Over twenty years of preparation, culminating in a conference convened at Basel last April by the Royal Anthropological Institute, have paved the way for the forthcoming Congress, which is modelled on the International Congress of Prehistoric and Protohistoric Sciences, whose first session was held in London last year. Like the latter, the Anthropological Congress is intended to meet at intervals of four years, *i.e.* always at an interval of two years between Prehistoric Congresses, and always in those years when the Americanist Congress meets in Europe (for example, at Seville in 1934).

Meetings will be held at University College, London, W.C.1, and at the Wellcome Historical Medical Museum close by. The opening session will be on Monday, 30 July 1934, and the sections, of which eight have been provisionally defined, will meet daily until Saturday, August 4. After that date visits will be arranged to the Universities of Oxford and Cambridge, to the Public Museums of Liverpool and Manchester, and to other places of interest. Communications and inquiries should be addressed to the Congress-Secretaries, c/o Royal Anthropological Institute, 52, Upper Bedford Place, London, W.C.1.

THE NAMES AUSTRIA AND AUSTRALIA

At first sight these two names, distinct in original meaning though both having reference to points of the compass, might be thought to have nothing in common, but students of historical geography are aware that there is a link between them in the bestowal, by Quiros, of the name Austrialia (*sic*) on the southern lands with definite reference to the Hapsburgs of Austria, though no doubt the idea of "Southern" was also kept in view by him. This connection has suggested to our Honorary Member, Professor E. Oberhumner, the well-known Austrian geographer, to trace the history of the two names through the centuries, which he has done in various papers kindly presented by him to our Library, particularly two printed respectively in the *Anzeiger* of the Vienna Academy for 1932 and in the *Mitteilungen* of the Vienna Geographical Society for 1933.

The older name of the two, Austria, has been dealt with by other scholars, whose conclusions Professor Oberhummer quotes, adding judicious comments of his own. In the old German form *Ostarrichi* the name appears as early as A.D. 996, *Austria* coming in later, in 1147. But long before this the Merovingian realm had been divided into a western and an eastern section, Neustrien and Austrasien, and a similar division of the Longobard kingdom in Northern Italy is a parallel case. The meaning "east" comes from a primitive Indo-Germanic root *Ausos*, rosy hue of dawn, but this true meaning had been almost forgotten by the twelfth century, when the *Austria* of the Babenbergers was taken as merely the Latin equivalent for *Oesterreich*. Thus started a curious confusion with the Latin *Auster*, *Australis*, the last epithet being even applied to the people of Austria as late as the sixteenth century. It is true that the Latin designation of the south wind (or rather any wind from south-east to south-west) came from the same or a kindred root—not, as is sometimes thought, through its meaning "to burn" (for it is always a rainy wind), but through its secondary meaning of east. Transferred from "east" to "south" in Italy (a shifting to which there are parallels elsewhere), it always had the latter meaning there. Thus Cicero speaks of a southern continent as Ora Australis.

The Professor next treats in some detail of the hypothetical ideas of a southern land-mass, habitable or uninhabitable, held by classical and mediaeval authors, the epithet *Australis* being still often used to describe it, as in the twelfth-century

map of Lambert of St. Omer. Although there is here nothing definitely new it is useful to have the various instances conveniently summarized. The same may be said of the later section dealing with the reports and nomenclature of the supposed Southern Continent in the age of actual discovery—a subject treated of in full by Rainaud in his 'Continent Austral' (1893) and incidentally by many other writers. The mention by Enciso (1519) of a *tierra que llaman austral* west of the Cape of Good Hope is probably an allusion to Vespucci's reported discoveries, and so too may be the portrayal of a continental land south of the Atlantic in the Turkish map of Piri Re'is spoken of in the September number of the *Journal* (and, we may add, in the map of Lopo Homem reproduced in the issue for March 1931). In one form or another the "Terra Australis" appears in most of the sixteenth-century maps from Finaeus, Schöner, and Desceliers to Mercator and Ortelius. As mentioned above, the first definite suggestion of Australia (in substantive form) for a new southern continent was due to the Spanish navigator Quiros. Professor Oberhummer ascribes to a recent Australian writer, Professor Lodewyckx, of Melbourne, the first demonstration that Quiros's name was definitely a play on "Austria." It may be true that this had not been so clearly insisted on before, yet in his introduction to the Hakluyt Society's edition of Quiros's Voyages (p. xxx) Sir Clements Markham had surely realized the fact when he said that Quiros gave the name Austrialia del Espiritu Santo "from his Majesty's title of Austria."

In its modern form the name is used by the Dutch circumnavigator Lemaire for the great south land in general, but curiously enough it was not applied by the Dutch to the land known to them as New Holland, and it was reserved for Flinders to definitely suggest for Australia the name which it now bears.

A PICTURE-MAP OF SOUTHERN ENGLAND, 1592

The Ditchley portrait of Queen Elizabeth lately shown at the National Portrait Gallery among other items of the Dillon bequest has an incidental interest for students of early cartography in that the floor covering on which the Queen is standing takes the form of a map of Southern England, from Kent to Devonshire inclusive, and extending north as far as Oxford, the length from east to west being about 3 feet 6 inches. This has some parallels in other noted pictures, one being Holbein's painting of "The Ambassadors," in which a world-map showing the track of Magellan is brought in in the background. The Elizabethan map has no importance as an original document, for it is almost certainly based on the general map in Saxton's Atlas of 1579, but is interesting as an instance of a use made of the latter within a few years of its publication, for the portrait was painted by an unknown artist to the order of Sir Henry Lee in honour of the Queen's visit to Ditchley in 1592. The counties are shown in separate colours with their names in Latin, and the rivers marked, together with a few of the more important places. The choice of some for such special prominence is not at once obvious, but a reason may be found on further examination. Thus Oatlands ("Otelant") and Nonsuch ("Nonesych") no doubt owed their inclusion to the palaces of Henry VIII, and the presence of "Middleton" in Dorset is explained when we find it more or less in the position of Milton Abbas. All the places marked had already appeared in Saxton's general map, though the spellings in many cases are different. Nonsuch does not appear in Norden's map of Surrey, though special prominence is as a rule given by him to Royal domains.

FORMER EXTENSION OF FORESTS IN CHINA

It is within common knowledge that the almost treeless surface of a large part of modern China does not represent its condition from the earliest days, but is

largely a result of ruthless destruction by the teeming population, for purposes both of agriculture and house-building. It is not easy to say what was the extent of the forest-cover at the beginning (say) of the Human epoch, but an attempt in this direction is made by a German writer, R. Mell, a zoologist long resident in southern China, in the *Zeitschrift* of the Berlin Geographical Society for June 1933. He bases his conclusions on the zoological evidence supplied by the survival of species of definite forest proclivities in many now isolated habitats, many in mountainous tracts, this distribution being explicable only on the assumption of a former wide extent of forest connecting these isolated areas. Of the species living only under forest conditions whose present distribution is used for the purpose of the study, 12 are birds, 22 reptiles, and 151 butterflies. On this basis the writer finds that an almost continuous forest in Kwangtung must have been continued south through Kwangsi and Hainan to the mountains of northern Tongking (with a further extension towards Burma and Yunnan), and north over Fukien, Chekiang, etc., with a coast extension to Shantung, and (with the exception of the loess-covered steppes) even to Manchuria. In the west a zoological link between Yunnan and the forested part of Szechwan is at present lacking, but one seems to be supplied, as in other parts of Central China, by the botanical researches of Handel-Mazzetti. From Szechwan to the Pacific coastal region the Yangtze valley supplied a continuous connection. The general result, shown in a sketch-map, is to indicate a more or less general forest cover over all southern China as far as the northern border of the Yangtze valley, with northward extensions up the east coast and farther inland towards the Hwangho basin. The writer does not venture to discuss the physical events to which the vicissitudes of the forests have been due, but points out that some chronological data for the former occurrence of the forest-loving elephant where now it is unknown may be had from the Chinese annals. Thus it swarmed in the Yangtze valley down to 500 B.C., and was common in Kwangtung and Kwangsi as late as A.D. 700.

BADEN GEOGRAPHICAL STUDIES

We have received from the Editor Nos. 9 and 10 of the *Badische Geographische Abhandlungen*, published by the Geographical Institutes of Freiburg i. Br. and Heidelberg. The first is a detailed description by Ernst Neef of the surface features of the Western Vorarlberg, lying around the Bregenzer Ach, and including the Bregenzer Wald. This area is a zone of transition between Alps and "foreland," and characterized by the development and extent of its glacial-fluviatile erosion forms. The writer has studied the area closely, and is able to disentangle the various geomorphological forms, which have been produced since the retreat of the ice-sheet by river-erosion, isolated ice-caps, glacial dams and lakes. He has especially studied the river profiles and their relation to the terraces, of which six out of the twenty-five systems traced are later than the post-Mindel subsidence of Lake Constance. These terraces decrease in age towards the north. Before this subsidence the Rhine and Ach belonged to the Danube system. Valley deepening in the upper Ach was almost as developed at the beginning of the ice age as it is to-day. The "Auen" of the Bregenzer Wald are over-deepened portions of river valleys; cwms are few, and not typical. His general hypothesis is the gradual incorporation of more and more of the "foreland" in the mountain complex.

In the second monograph Kurt Scharlau examines the question of depopulation of the countryside during the Middle Ages, distinguishing between the relative parts played by geographical and other influences, economic and social. Except in extreme cases, such as river-flooding, geographical factors came into

play only in so far as it was the geographically unfavoured areas that responded first to outside attractions.

SUN-HEATING AND ROCK-WEATHERING

In a paper entitled "Insolation Hypothesis of Rock-Weathering," contributed to the Symposium on Desert Physiography held at Pasadena, California, on the occasion of the Meeting of the American Association for the Advancement of Science in June 1931, Mr. Eliot Blackwelder challenges the widely accepted view that heating by the sun followed by rapid cooling is the chief cause of the disintegration of desert rocks (*Amer. J. Sci.*, August 1933). It is pointed out that this doctrine, due mainly to Johannes Walther at the end of the nineteenth century, rests on little more than an hypothesis. Rocks are hardly ever exposed to a daily range of temperature greater than 50° C., and practically all rocks are capable in the laboratory of withstanding sudden changes of temperature amounting to 200° or even 300° C. without fracture. For this and various other reasons it is argued that solar heating cannot be the cause of rock-splitting in deserts by any rapid process. It is probable however that the constant expansion and contraction due to alternations of day and night temperature continued through centuries loosen the minerals and facilitate the entrance of moisture, and so promote the breaking up of the rocks by the expansive effect of chemical changes.

It is noteworthy that rocks like granite, gneiss, and syenite which contain complex silicates decompose much more readily under the influence of moisture than others like basalt and quartzite.

The author concludes that rock-weathering is due to the complex interplay of a number of processes which are far from being well understood. Solar heating may be regarded as one of those, but its precise importance has yet to be determined. Other factors mentioned are frost, fire, and lightning. In view of the complexity of natural processes in general it would seem that this new statement of the case is reasonable.

ORIGIN OF SUBMARINE CANYONS

Dr. Francis P. Shepard, who in the August issue of the *Geographical Journal* criticizes the views of the late Professor J. W. Gregory concerning the origin of particular submarine troughs, considers the general subject of "Canyons beneath the Seas" in an article contributed to the *Scientific Monthly* for July. After indicating that these features cannot be ascribed to faulting or rifting, nor to ocean currents, nor yet to river erosion notwithstanding their V-shaped cross section and apparent continuation in many cases of the courses of rivers beneath the sea, Dr. Shepard proceeds to find the missing factor in the reopening by landslides of troughs formed by river erosion in a previous geological age of high relief, and since filled in by sediments on submergence. Evidence for this theory is supplied by the great earthquake which in the autumn of 1929 disturbed the ocean bottom to the south-west of the Grand Banks of Newfoundland, breaking cables over a large area, and causing great destruction by tidal waves in Newfoundland. It was found a few days later that the outer continental shelf off New England had been depressed during the earthquake, and subsequent charting of Georges Bank by the U.S. Coast Survey between 1930 and 1932 has revealed a new submarine valley called Corsair Gorge. It is argued that had this deep gorge been caused by sudden faulting the surrounding lands would have furnished abundant seismometric evidence which is entirely lacking. It seems probable that Corsair Gorge was produced by a large submarine landslide set off by shaking from the Grand Banks earthquake.

Application of this theory to submarine troughs in general is supported by their common location near the steep slopes of continental shelves which are subject to earthquakes, and by the water-logged character of the clayey deposits with which they are filled. All these factors favour landslip action. But inasmuch as the cross-section of the trough is V-shaped, and not cirque-like, as in the scars left by landslides on land, and as it should be if the submarine material merely broke away from a soft continental shelf, their fluviatile origin in a former geological age is postulated by Dr. Shepard.

RAINFALL AT FOOT OF CAMEROONS MOUNTAIN

Among a number of meteorological stations established in the neighbourhood of Cameroons mountain before the war by German settlers and missionaries that at Debunja, on the coast near the south-western foot has a record almost uninterrupted from 1894. This record is discussed in the *Annalen der Hydrographie und Maritimen Meteorologie* (Heft V and VI, 1933), by W. Semmelhack, who represents Debunja, with a mean annual rainfall of 380 inches, as the wettest spot at sea-level in the world, and thinks it probable that there are places high up on the windward side of the mountain which are even wetter than the mountain stations of Cherrapunji in Burma and Waileale in Hawaii—the two wettest places known on earth.

By its position 4° north of the equator Debunja might be expected to get "zenithal" rains twice a year near the equinoxes. Actually the zenithal rains are over-ridden by the south-west monsoon which, attaining its greatest development during the northern summer, causes July, with an average rainfall of 60 inches, to be the wettest month, September following with 56 inches. A weak secondary maximum in March, attributed by the author to zenithal influence, is obscure, since this ought rather to occur in April, especially when allowance is made for the effect of lag. The variability is great, as much as 582 inches having fallen in 1919 and only 273 in 1909. Debunja is truly one of the rainiest places in the world, since this large annual fall is distributed over 261 days of measurable rainfall, including 64 days with over 2 inches. But it cannot be said that the maximum amount of rain recorded in 24 hours, namely 18 inches in June 1902, is outstanding for a tropical climate, in comparison with such a record, for instance, as 46 inches at Baguio in the Philippines in July 1911.

MASSACHUSETTS ICE SHEET

In an article entitled "The Waning of the Last Ice Sheet in Central Massachusetts," in the *Journal of Geology* for February–March 1933, Mr. Thomas B. Brown refers to divergent views current concerning the mode of retreat of the New England ice, and proceeds to discuss the character of the deposits in the Nashua and other valleys of central Massachusetts in relation to the problem. He shows that the structure and material of the eskers and correlated features signify almost entirely a local origin for the glacial deposits, making it probable that the ice remained in the valleys as long narrow tongues after the main sheet had disappeared from the higher land. There is evidence that the valley glaciers continued to move and developed large crevasses into, and through, which flowed the ordinary valley drainage charged with sediments which formed the esker ridges and valley plains so characteristic of the Nashua valley. Finally, the valley ice became stagnant, and on melting left behind till-covered areas, now swamps, in the deeper parts of the valley. In the case of a region of only moderate relief like New England there does not seem to be any reason to regard the disappearance of the ice from the higher ground first as climatically improbable. The effect would certainly be to produce anomalies in the local distribution of temperature.

OBITUARY

LADY CLAYTON-EAST-CLAYTON

In the spring of 1932, within a few weeks of her marriage, Lady Clayton-East-Clayton had accompanied her husband in his flight to Egypt, though she had not taken part in the actual reconnaissance of the Gilf Kebir described in the *Journal* for March 1933. A few weeks after their return Sir Robert Clayton died, and it was natural that the air and the desert became from that time the dominant interest in his widow's life. Being resolved to qualify herself for continuing his work in desert exploration Lady Clayton joined the Society and took lessons in survey and navigation from Mr. Reeves.

In March of this year she flew her machine to Egypt and in company with a friend set out to complete the work begun by her husband. A study of the conditions convinced her that the aeroplane would have been a source of anxiety rather than a help to the expedition, so she proceeded with camels and lorries to the west of the sand sea. There she joined P. A. Clayton, who was making one of his tours of desert survey, and together the two expeditions accomplished much geographical work. Zerzura they did not find, and the mystery remains to draw others in their path.

On September 15 she was accidentally killed while taking off in a flight at Brooklands. By her death, so soon following her husband's, the Society has lost two ardent explorers who would, had they lived, have achieved much more in desert reconnaissance.

WILLIAM JOHN CHARLES KENNEDY COCHRAN-PATRICK

Major Cochran-Patrick, D.S.O., M.C., was killed in an air crash just after he had left the Johannesburg aerodrome on a flight to Northern Rhodesia on September 26 last. In this accident a gallant gentleman has died and air survey has suffered a severe loss.

Charles Cochran-Patrick was born in 1896, the only son of Captain and Mrs. Neil Cochran-Patrick, of Ladyland, Ayrshire. He was educated at Wellington College, and went up to Trinity College, Cambridge. On the outbreak of the war he was transferred to Sandhurst, and in 1915 received his commission in the Rifle Brigade. Having learnt to fly he was seconded for service with the R.F.C. in June of the same year, and shortly afterwards went over to France. Then he began a very distinguished war career, in the course of which he was awarded the D.S.O. and the M.C. and bar. While in command of No. 60 Squadron he was awarded the D.S.O. as recorded in the *London Gazette*, "For conspicuous gallantry and devotion to duty on numerous occasions in destroying and driving down hostile machines, frequently engaging the enemy with great dash and fine offence spirit when encountered in superior numbers. By his cool judgment and fearlessness he has instilled confidence in all around him, his brilliant leadership being chiefly responsible for his numerous successes." He was a Major in the Rifle Brigade at the age of twenty-one, and retired with that rank in 1919, when he was only twenty-three.

On retirement he took up civil aviation, and directed his attention to air survey. His first work in this line was to photograph the Delta of the Orinoco together with surveys in British Guiana. The next work he undertook was with Mr. Ronald Kemp, the survey of the Irrawaddy Delta in Burma for the Survey of India and the Indian Forest Department. We believe this was the largest area photographed from the air at that date. His next venture was to join the Aircraft Operating Company which had recently been formed by Mr. Alan

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Butler and Major Hemming, of which Cochran-Patrick became a director. He was in charge of several large surveys carried out by that company, notably an area of over 70,000 square miles in Northern Rhodesia for the Government of that Colony, including large-scale surveys of many townships for development purposes and a large-scale survey of over 1000 square miles in 'Iraq for irrigation and land settlement. Notwithstanding the slump, from which air survey has suffered so severely, he went out to South Africa a few years ago, and again with Mr. Butler, formed the Aircraft Operating Company of South Africa, of which he was managing director at the time of his death.

Cochran-Patrick was a tremendous worker and displayed extraordinary ingenuity in overcoming those many difficulties which arise in the course of an air survey. He was a born leader of men and would never ask any one to do anything he was not prepared to do himself. He also possessed an extraordinary flair for country. He photographed, with verticals, some 1000 square miles in 'Iraq without a gap, no small achievement in a country so devoid of landmarks.

It was a pleasure to work with one of his engaging and delightful personality. He leaves a widow and one son. H. L. E.

HENRY FAIRBANKS MONTAGNIER

Those interested in mountaineering and its literature will have read with regret of the death of Mr. Montagnier which occurred on July 16 at Montreux, the result of a comparatively trivial operation. His surname was French, but his ancestors had emigrated to the United States many generations back, and he was born, in 1877, at Cincinnati, Ohio. He came to Europe as a young man, and becoming an enthusiastic mountaineer, was elected a member of the Alpine Club in 1903 and a Fellow of our Society in 1906. The history of mountaineering, in particular the climbing and military history of the Alps, was his life's greatest interest, and he was the owner of a library of many thousand volumes, the Alpine section alone reaching four figures. His numerous contributions to French and Swiss journals are not widely known in this country; but his many articles in the *Alpine Journal* and his help in the books of his friends are of permanent value, for he was a tireless searcher in libraries and archives. Mr. Freshfield acknowledges his invaluable assistance in compiling the 'Life of H. B. de Saussure.' "My personal experience," he adds, "has been that Mr. Montagnier was the most capable and generous colleague in literary work, and I count it my good fortune to have received his friendly help for many years."

Mr. Montagnier's own mountaineering record was good and included some months' exploring in the Himalaya. In this field as in others he proved most generous, and actively assisted the Himalayan Club by becoming a founder member and giving a substantial donation to the foundation fund. He also made a handsome offer of help to Professor Kenneth Mason in connection with his work in the Shaksgam, and, on the basis of a letter of introduction from the latter, accepted as his guest any young member of the Himalayan Club who wished to learn climbing from trained Swiss guides: an offer of which four persons had availed themselves.

In a long notice in the *Alpine Journal* which the Editor has kindly allowed us to see in proof, Dr. Wilson describes Mr. Montagnier's personality as that of a "good companion of pleasantly *bon-vivant* disposition, the *raconteur* with a tendency to impart ingenuous confidences on which one looks back with the smile of congenial reminiscence, the perfect host, the equally appreciative guest." He possessed however "a streak of shyness which for long prevented him from venturing into print unless with a companion, and which throughout his life made it an impossibility for him ever to read a paper or deliver a lecture."